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New Jersey Respiratory Associates

NURSE COMPETENCY PROGRAM

SNF Respiratory Managment



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Oxygen Delivery Devices:

Stationary Oxygen Concentrators





Stationary Oxygen Concentrators Instruction Check Sheet

Demonstrate:

- _____ Proper placement of machine
- _____ How to turn machine on
- _____ How to adjust flow control knob
- _____ Alarm function
- _____ How/when to clean filter
- _____ How to care for the cabinet
- _____ How to attach humidifier
- _____ How to analyze O₂ and check liter flow

Explain:

- _____ Indications for oxygen therapy
- _____ Oxygen devices used with oxygen concentrators
- _____ Safety precautions/Electrical Hazards

Nurse: _____

Instructor: _____

Date: _____

Stationary Oxygen Concentrators

Overview

1. Oxygen concentrators are use for residents on continuous oxygen.
2. Liter flow is from 1-10 lpm.
3. Concentrator should be placed 12-18 inches away from wall to insure proper ventilation of machine.
4. Rear filter should be checked daily and cleaned with soap and water as needed.
5. Humidifiers may be used on concentrators.
6. Oxygen delivery devices and humidifiers should be changed weekly
7. Oxygen concentrators should analyzed as per manufacturer's recommendations.
8. There is no smoking allowed anywhere where oxygen is used. Post a NO SMOKING sign.
9. Oxygen therapy should be used carefully in residents with COPD due to the possibility of hypercarbia.
10. Alarm will sound when electrical source is disconnected.



Stationary Oxygen Concentrators Instructions

1. Plug the electrical cord into an outlet. **DO NOT** use an extension cord.
2. Keep back from sides of unit at least six inches from drapes or walls.
3. Attach the humidifier (jar of sterile water) to the outlet of the machine. This adds humidity to the oxygen to keep your nose from becoming too dry. (If ordered by physician)

NOTE: If the bottle is on properly, bubbles will appear in the humidifier bottle when the machine is turned on

4. Attach the nasal cannula to the outlet on the top of the humidifier. You are now ready to use the oxygen concentrator.
5. Turn the machine on. You will hear an “alarm” which is normal and will stop in several seconds.
6. Make sure the flow is set at the prescribed amount.
7. Place the nasal cannula in patients nose. This is most easily done by inserting the ‘prongs’ first into each nostril and then placing the tubing over each ear. Tighten the “Lariat” under your chin until the cannula is comfortable.

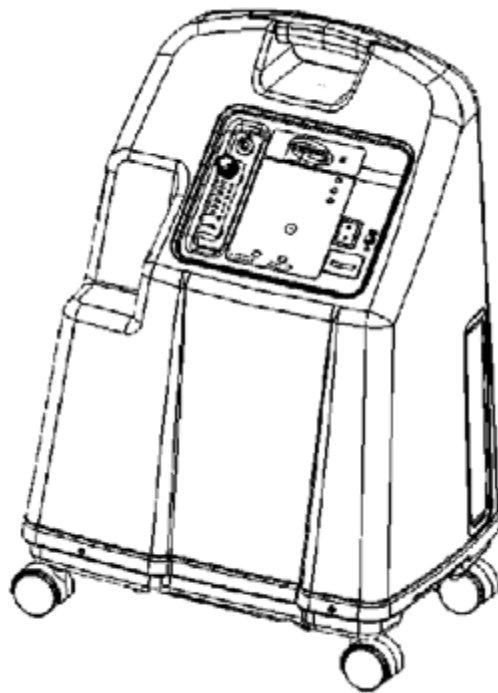
NOTE: The “prongs” should be pointing downwards when inserting.

TROUBLE SHOOTING:

ALARMS: Your oxygen concentrator has alarms, which will tell you if the machine is not functioning properly. If you hear or see one of the alarms of if there is a power outage or machine malfunction, turn machine off. Use your back up oxygen cylinder.

Stationary Oxygen Concentrators
Operators Manual

Invacare Platinum™ Series



*The following is an excerpt from Invacare's Platinum Series
Operators Manual*

SECTION 5—OPERATING INSTRUCTIONS

SECTION 5—OPERATING INSTRUCTIONS

Introduction

Your oxygen concentrator is intended for individual use indoors. It is an electronically operated device that separates oxygen from room air. It provides high concentration of oxygen directly to you through a nasal cannula. Clinical studies have documented that oxygen concentrators are therapeutically equivalent to other types of oxygen delivery systems.

Your provider will show you how to use your oxygen concentrator. He/She should be contacted with any questions or problems regarding your oxygen concentrator. This owner's manual will tell you about your concentrator and will serve as a reference as you use your concentrator.

Select a Location

WARNING

NEVER block the air openings of the product or place it on a soft surface, such as a bed or couch, where the air opening may be blocked. Keep the openings free from lint, hair and the like. Keep unit at least 3 inches away from walls, draperies, furniture, and the like.

You may select a room where using your oxygen concentrator would be most convenient. Your concentrator can be easily rolled from room to room on its casters.

The air intake of the unit should be located in a well ventilated area to avoid airborne pollutants and/or fumes. DO NOT place in a closet.

Set-Up

Plug in Power Cord

Plug in power cord to an electrical outlet.

⚠ POLARIZED PLUG WARNING

As a safety feature, this appliance may have a polarized plug (one blade is wider than the other). This plug will fit in a polarized outlet only one way. If the plug does not fit fully in the outlet, reverse the plug. If it still does not fit, contact a qualified electrician. DO NOT attempt to defeat this safety feature.

Connect Humidifier (If So Prescribed)

⚠ WARNING

DO NOT overfill humidifier.

DO NOT reverse the oxygen input and output connections. Water from the humidifier bottle will travel through the cannula back to the patient.

NOTE: For this procedure, refer to FIGURE 5.1, FIGURE 5.2 and FIGURE 5.3 on page 18 and FIGURE 5.4 on page 19.

NOTE: For Platinum 5, XL - recommended humidifiers are: Invacare 3260, 003-40, or 006-40. For Platinum 10, recommended humidifiers are high flow: 7900-10, 7900-25.

1. Remove cap and fill humidifier bottle with distilled water to the level indicated by the manufacturer.
2. Replace the humidifier cap and securely tighten.

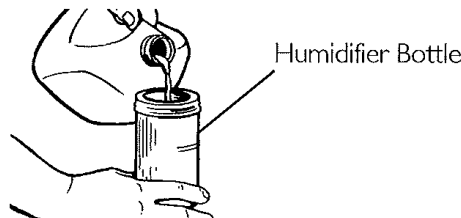


FIGURE 5.1 Filling the Humidifier

SECTION 5—OPERATING INSTRUCTIONS

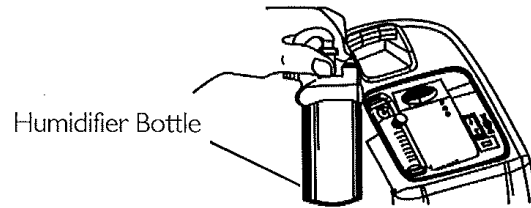


FIGURE 5.2 Humidifier Compartment

3. Remove the filter access door located on the side of the concentrator. Insert a flathead screwdriver in the plate groove on the top edge of the filter access door and gently pry the filter access door open. Refer to Detail "A" in FIGURE 5.3.
4. The humidifier adapter is next to the inlet filter. Pull up and remove the humidifier bottle adapter. Refer to Detail "B" in FIGURE 5.3.
5. Attach it to the humidifier by turning the wing nut on the humidifier bottle counterclockwise until it is securely fastened. Refer to Detail "C" in FIGURE 5.3.
6. Place the humidifier bottle in the humidifier compartment.

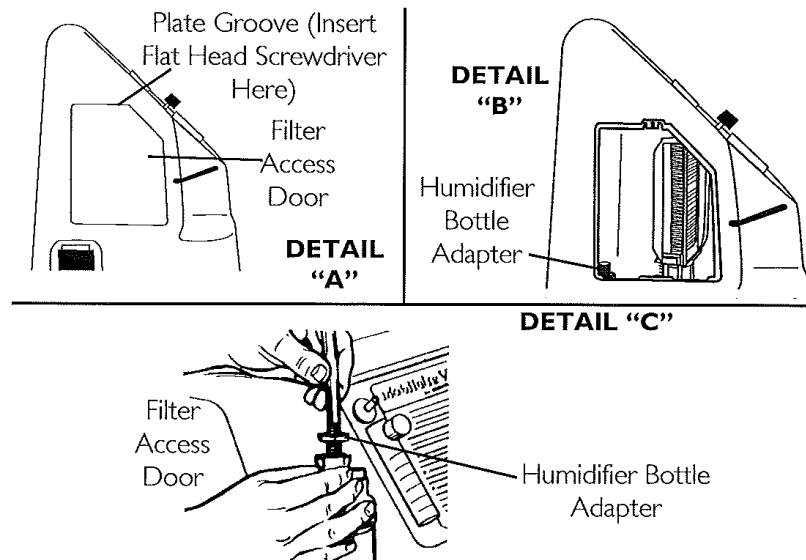


FIGURE 5.3 Attaching the Humidifier Bottle Adapter

SECTION 5—OPERATING INSTRUCTIONS

7. Attach oxygen tubing from the humidifier bottle to oxygen outlet connector on the oxygen concentrator (FIGURE 5.4).
8. Attach the cannula/patient supply tubing to the humidifier bottle outlet (FIGURE 5.4).
9. After assembly, ensure that oxygen is flowing through the cannula.

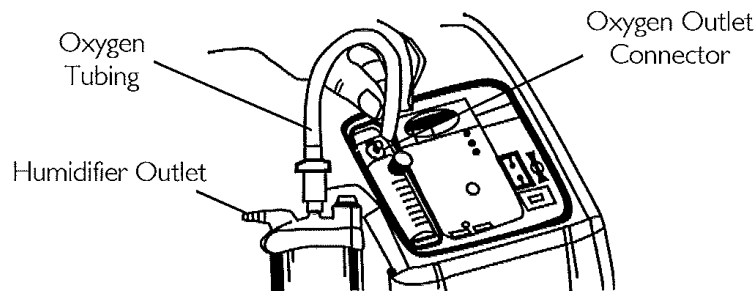


FIGURE 5.4 Attaching the Oxygen Tubing

Power Switch

NOTE: For this procedure, refer to FIGURE 5.5 on page 19.

1. Press power switch to on position. All the panel lights and the audible alarm will come on for one second, indicating that the unit is functioning properly.

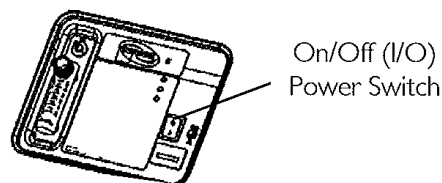


FIGURE 5.5 Power Switch

SECTION 5—OPERATING INSTRUCTIONS

Flowrate

NOTE: For this procedure, refer to FIGURE 5.6 on page 20.

1. Turn the flowrate knob to the setting prescribed by your physician or therapist.

CAUTION

Never set the flow greater than 5 L/min on the IRC5.
 Never set the flow greater than 10L/min on the IRC10.

⚠ WARNING

DO NOT change the L/min setting on the flowmeter unless a change has been prescribed by your physician or therapist.

NOTE: To properly read the flowmeter, locate the prescribed flowrate line on the flowmeter. Next, turn the flow knob until the ball rises to the line. Now, center the ball on the L/min. line prescribed.

2. If the flowrate on the flowmeter ever falls below 0.5 L/min for Platinum 5 (1 L/min for Platinum 10) for more than about one minute, the LOW FLOW alarm will be triggered. This is a rapid beeping of the audible alarm. Check your tubing or accessories for blocked or kinked tubing or a defective humidifier bottle. After rated flow is restored, more than 0.5 L/min for Platinum 5 (1 L/min for Platinum 10), the LOW FLOW audible alarm will go off.

NOTE: The use of some accessories such as the pediatric flowstand and the HomeFill compressor will deactivate the Low Flow Alarm.

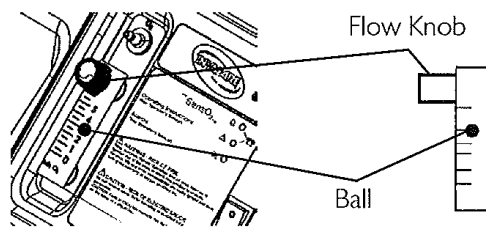


FIGURE 5.6 Flowrate

Front Panel Indicators - Units with SensO₂

NOTE: For this procedure, refer to FIGURE 5.7.

The SensO₂ feature monitors the purity of oxygen generated by the oxygen concentrator. If purity falls below factory preset standards, indicator lights on the control panel will illuminate.

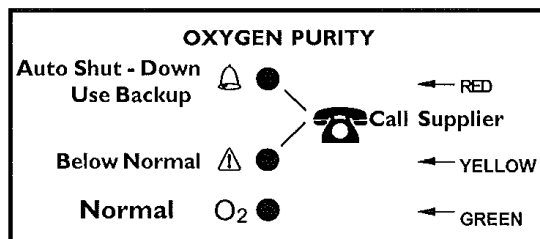


FIGURE 5.7 Front Panel Indicators - Units with SensO₂

Initial Startup of the Concentrator

NOTE: Concentrator may be used during the initial start warm-up time (approximately 30 min.) while waiting for the O₂ purity to reach maximum.

LABEL SYMBOL	O ₂ PURITY	INDICATOR LIGHTS (LED)
O ₂	SYSTEM OKAY O ₂ over 85% (± 2%)	GREEN Indicator Light
⚠	O ₂ Between 73% (± 3%) to 85% (±2%)	YELLOW Indicator light A. YELLOW Solid B. YELLOW Flashing Sensor Failure Call a qualified technician. Have a back-up supply of oxygen ready.
🔔	SYSTEM FAILURE O ₂ Below 73% (±3%)	RED Indicator Light Continuous Audible Alarm Sieve-GARD Compressor Shut-down. Call a qualified technician. Switch to a back-up supply of oxygen immediately.

SECTION 5—OPERATING INSTRUCTIONS

Front Panel Indicators - Units without SensO₂

NOTE: For this procedure, refer to FIGURE 5.8.

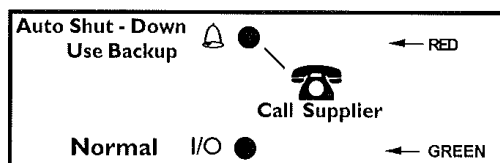


FIGURE 5.8 Front Panel Indicators - Units without SensO₂

Initial Startup of the Concentrator

NOTE: Concentrator may be used during the initial start warm-up time (approximately 30 min). O₂ purity will build to a maximum during this period.

LABEL SYMBOL	STATUS	INDICATOR LIGHTS (LED)
I/O	SYSTEM OKAY	GREEN Indicator Light
	SYSTEM FAILURE	RED Indicator light Continuous Audible Alarm Sieve-GARD™ Compressor Shutdown Call a qualified technician. Switch to a back-up supply of oxygen immediately.

Oxygen Delivery Devices:

Portable Oxygen Concentrators





Portable Oxygen Concentrators Training Check Sheet

Demonstrate:

- _____ Proper placement of machine
- _____ How to turn machine on
- _____ How to adjust flow including pulse dose settings
- _____ How to change and charge battery
- _____ How to attach to cart and wheelchair
- _____ Alarm function
- _____ How/when to clean filter
- _____ How to analyze O₂ and check liter flow

Explain:

- _____ Indications for oxygen therapy
- _____ Oxygen devices used with oxygen concentrators
- _____ Safety precautions/Electrical Hazards

Nurse: _____

Instructor: _____

Date: _____

Portable Oxygen Concentrators

Overview

1. Portable oxygen concentrators are used for mobile residents requiring continuous or pulsed oxygen.
2. Portable oxygen concentrators can operate using A/C, D/C or battery power.
3. Extra batteries are always available on the desktop charger.
4. Continuous liter flow is from 1-3 LPM and Pulse Dose ranges from FIO₂ settings from 25-45%.
5. Rear filter should be checked daily and cleaned with soap and water as needed.
6. Humidifiers may be used on concentrators.
7. Oxygen delivery devices and humidifiers should be changed weekly
8. There is no smoking allowed anywhere where oxygen is used. Post a NO SMOKING sign.
9. Oxygen therapy should be used carefully in residents with COPD due to the possibility of hypercarbia.
10. Alarm will sound when electrical source is disconnected or battery is low on charge.



Portable Oxygen Concentrators

Instructions

1. Make sure unit is either plugged in or battery has sufficient charge.
2. Attach the nasal cannula to the outlet. You are now ready to use the oxygen concentrator.
3. Turn the machine on. You will hear an “alarm” which is normal and will stop in several seconds.
4. Make sure the flow is set at the prescribed amount.
5. Place the nasal cannula in your nose. This is most easily done by inserting the ‘prongs’ first into each nostril and then placing the tubing over each ear. Tighten the “Lariat” under your chin until the cannula is comfortable.

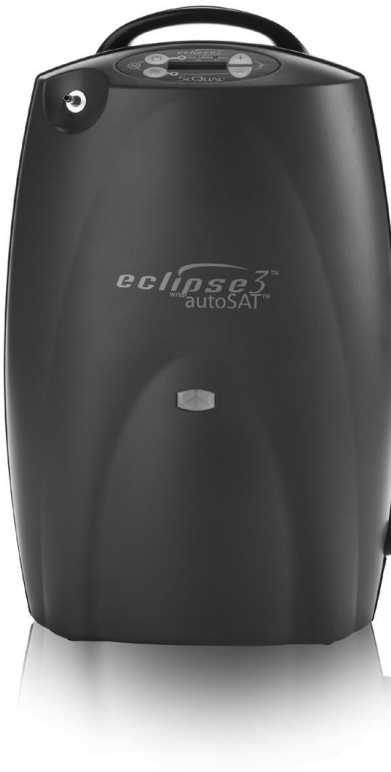
NOTE: The “prongs” should be pointing downwards when inserting.

TROUBLE SHOOTING:

ALARMS: Your oxygen concentrator has alarms, which will tell you if the machine is not functioning properly or is low on battery. If you hear or see one of the alarms or there is a power outage or machine malfunction, turn machine off. Use your back up oxygen cylinder.

**Portable Oxygen Concentrators
Operators Manual**

SeQual Eclipse 3™ with autoSAT®



*The following is an excerpt from SeQual's Eclipse 3
Operators Manual*



INTRODUCTION TO YOUR ECLIPSE 3

This Users Manual will inform you of the use and care of the Eclipse and its standard components. Please read all of the information in this manual before operating your Eclipse. Contact your home care provider for proper training on the use and care of this device.

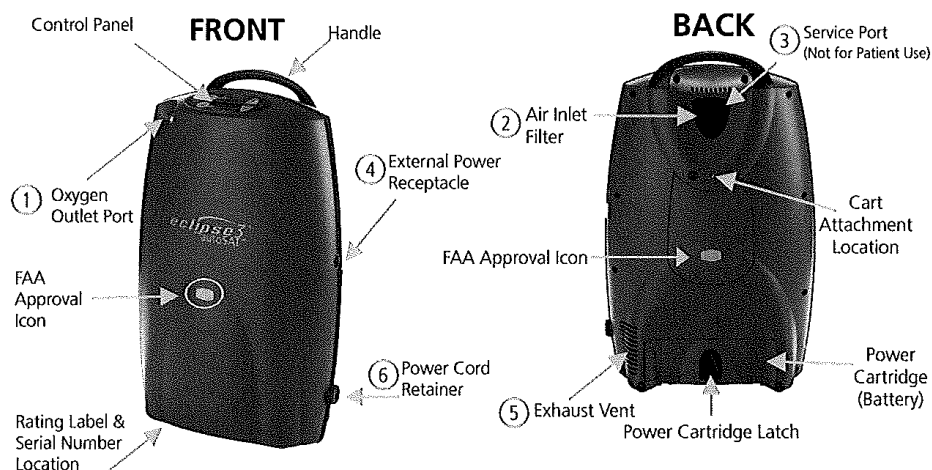
Your physician has prescribed supplemental oxygen as part of a treatment plan. Long-Term Oxygen Therapy (LTOT) is now widely accepted as the standard treatment for chronic hypoxia caused by Chronic Obstructive Pulmonary Disease (COPD).

The Eclipse may be used in the home, an institution, a motor vehicle or in a commercial airplane.

Your physician has prescribed specific oxygen flow settings to meet your individual clinical needs.

- at rest • during activities or exercise • at night • for travel at altitude •

Become familiar with the key features of the Eclipse and the user control panel.



- | | |
|---------------------------------------|---|
| ① Oxygen Outlet Port | Oxygen supply tubing or a cannula is attached to this port. |
| ② Air Inlet Filter
top rear | Ambient air is drawn into the device through the air inlet. This air inlet filter prevents dust and debris from entering the Eclipse and should be cleaned regularly. |
| ③ Service Port | This connection, located behind the air inlet filter, allows qualified service personnel to diagnose and monitor the Eclipse performance. This port is not intended for the user. |
| ④ External Power Receptacle | The Eclipse AC or DC Power Supply cords may be connected to this receptacle. |
| ⑤ Exhaust Vent | Exhaust air from the Eclipse exits the device from this vent. |
| ⑥ Power Cord Retainer | Retainer to secure the Power Cord. |

9 ⑥ **Power Cord Retainer** Retainer to secure the Power Cord.

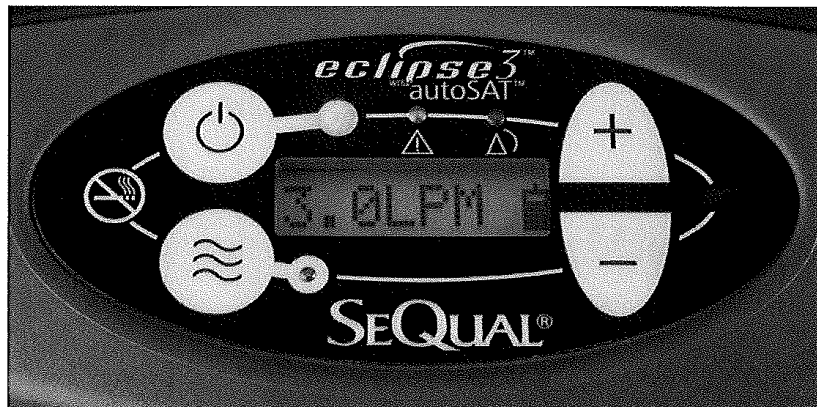
HOW YOUR ECLIPSE 3 WORKS

The Eclipse 3, Personal Ambulatory Oxygen System with autoSAT Technology is a portable concentrator used to extract oxygen from the atmosphere, concentrate it to greater than 90% and present it to the patient. The device will operate in Continuous Flow or Pulse Dose Modes. In Continuous Flow Mode the oxygen is provided at a constant flow rate between 0.5 and 3.0 LPM. In Pulse Dose Mode, oxygen is supplied in a bolus at the beginning of each inspiration, providing a selectable range setting of 16mL to 192mL.

The Eclipse 3 operates from either external power or from an internal rechargeable battery. The system includes a "Smart Battery" charger that recharges the internal battery whenever the Eclipse is connected to external power. The system monitors and controls the power source and the battery charger.

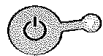
The Eclipse 3 separates oxygen from ambient air. The air is filtered and then separated into oxygen and nitrogen, the nitrogen is then purged. This cycle concentrates the oxygen.

UNDERSTANDING THE CONTROLS ON THE CONTROL PANEL



USER CONTROLS AND SYSTEM STATUS INDICATORS

The Eclipse control panel displays important operating information. This section will help you understand this operating information.



ON/OFF Button (Green) Indicator: This button powers the device ON or OFF. The Green Indicator is illuminated when the device is ON.



Increase or Decrease Flow Setting Buttons:

Use these buttons to set the flow to your prescribed setting.



Delivery Mode Button and Indicator: The button toggles between Continuous Flow and Pulse Dose Mode. The Pulse Dose Mode activates autoSAT Technology—as your breath rate changes, the Eclipse servo-controls the unit to provide a consistent bolus size. The Pulse Dose Mode allows a significant increase in the operating time while powered by the battery. When this mode is activated, the green Pulse Dose Mode Indicator illuminates and a pulse of oxygen is delivered with each inspiratory effort.



ALERT (Yellow) Indicator—Low and Medium Priority Alerts:

When illuminated, this indicates a low priority awareness condition or Caution. Continue to use your system and refer to the Troubleshooting Table for the proper response. A flashing yellow indicates a medium priority alert. A prompt response is necessary.



ALARM (Red) Indicator—High Priority Alarms: Indicates a high priority alarm condition. An immediate response is necessary. Refer to the Troubleshooting Table and contact your home care provider.



Flow Setting Indicator: This is the main focus on your control panel. Your home care provider will correctly set your prescribed flow for the Continuous Flow Mode (LPM) and/or your Pulse Dose Mode (mL) settings. Each time you power the device ON, the previous mode and/or setting has been saved and will be used at start-up.



Power Cartridge (battery) Status Gauge: This indicator displays the charge remaining in the battery. Each of the five horizontal gray bars represents approximately 20% of the total battery charge. When the battery is being charged, the charge indicator bars will blink in a waterfall-type fashion.

If the battery is not installed, or if it is improperly installed, the Power Cartridge (battery) Status Gauge will not be illuminated.



External Power Indicator: When the Eclipse is properly plugged in and is using the AC or DC Power Supply, this indicator will appear on the User Control Panel.

Buzzer: An audible alarm (or buzzer) is used to alert you to the operating condition of the device, either a warning or failure, and to confirm a valid key press by the user.

CAUTION:

PLACE THE DEVICE IN A WELL-VENTILATED AREA THAT PROVIDES ADEQUATE AIR MOVEMENT. PERIODICALLY CHECK IF AIR IS BEING PREVENTED FROM ENTERING OR EXITING THE DEVICE BY OBSTRUCTIONS SUCH AS FURNITURE, DRAPERIES, BEDDING, CLOTHING OR PETS.

OPERATING INSTRUCTIONS

BEFORE OPERATING

This users manual serves as your reference to help you operate and maintain the device. If you have any questions or concerns please call your home care provider.

Important! **DO NOT** attempt to operate the Eclipse without first reading the Safety Guidelines section of this manual. Please follow all of the operating instructions. Please observe all **WARNINGS** on the device and in the Users Manual. In order to reduce the risk of fire, personal injury and serious damage to the Eclipse, please observe all of the safety precautions.

WARNING:

PROTECT THE ECLIPSE AND ALL POWER SUPPLIES FROM FLUID SPILLS OR FLUID DRIPS TO AVOID POSSIBLE SHOCK HAZARDS.

CAUTION:

ALWAYS CHECK THAT THE AIR INLET AND THE EXHAUST VENT OF THE DEVICE ARE NOT BLOCKED AND THE AIR INLET FILTER IS CLEAN AND DRY BEFORE USING YOUR ECLIPSE.

POWERING ON YOUR ECLIPSE

The device is capable of being operated directly from 3 different power sources:

- AC Power Supply with NEMA Power Cord
- DC Power Supply
- Rechargeable Power Cartridge (Battery)

GENERAL CHARGING INFORMATION

The Eclipse charges the battery while using AC power and the battery temperature is within safe charging temperature. When external power is disconnected, the device will automatically switch over to the battery, if the battery is installed and charged. When external power is restored, by plugging into an AC outlet, the device will accept power from the external power source and replenish the battery.

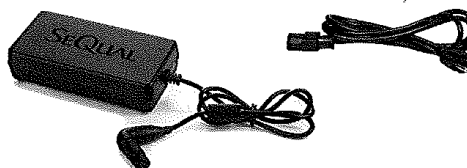
Proper connection of the AC or DC Power Supply requires aligning the power plug with the recessed external power receptacle of the device. The recessed external power receptacle is located on the right side of the device when facing the Control Panel. Push the power plug into the recessed receptacle.



WARNING:

DO NOT USE ANY POWER CORD IF IT IS DAMAGED OR FRAYED. IMPROPER USE OF THE POWER CORD MAY RESULT IN A FIRE HAZARD. **DO NOT** TOUCH THE METAL CONNECTORS INSIDE THE POWER COMPARTMENT CABINET WITH THE DEVICE CONNECTED TO AN EXTERNAL AC OR DC POWER SOURCE. THIS MAY RESULT IN AN ELECTRICAL SHOCK

AC Power Supply
with NEMA Power Cord
Item# 5941

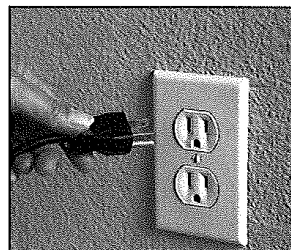


AC POWER SUPPLY: The Eclipse includes a universal AC Power Supply for use at home, or wherever standard AC power is available. To connect to an AC power source, be sure the AC Power Supply cord is securely inserted into the recessed power receptacle on the side of the device and that the cord from the AC Power Supply is plugged into a grounded AC outlet. When the Eclipse is plugged in properly, a green indicator on the AC Power Supply will light and the **External Power Indicator**,  will appear on the user control panel.

Step ①



Step ②



CAUTION:

THE AC POWER CORDS USED WITH THE ECLIPSE MUST MEET THE ELECTRICAL REQUIREMENTS OF THE COUNTRY WHERE THE DEVICE IS USED.

USE ONLY WITH A GROUNDED, 3-PIN RECEPTACLE. DO NOT REMOVE THE GROUNDING PIN FROM THE POWER CORD. USE ONLY WITH SEQUAL SUPPLIED POWER CORDS.

DO NOT CONNECT THE ECLIPSE TO AN EXTENSION CORD, POWER STRIP OR TO AN ELECTRICAL OUTLET CONTROLLED BY A SWITCH.

ALWAYS DISCONNECT AC POWER SUPPLY FROM THE WALL BEFORE DISCONNECTING THE AC POWER SUPPLY FROM THE ECLIPSE.

DC Power Supply



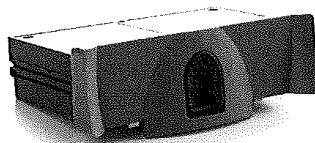
Item# 5942

A DC Power Supply allows the system to operate from DC outlets, such as those found in motor vehicles.

1. Start your vehicle.
2. Insert the DC cord into the recessed power receptacle on the side of the device.
3. Insert the DC Power Supply plug into the DC power outlet in your motor vehicle.

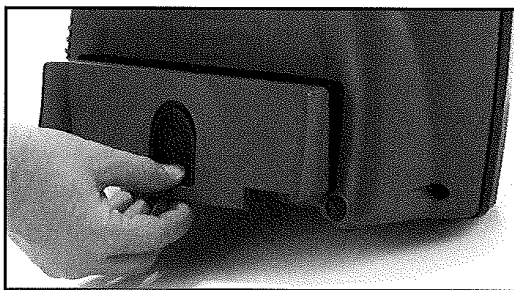
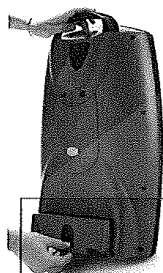
Rechargeable Power Cartridge (Battery)

Item#7082



RECHARGEABLE POWER CARTRIDGE (Battery): The Eclipse can be powered by the rechargeable Power Cartridge (Battery), which is supplied with the device.

Installing the Battery: Align the Battery so that it will slide into the empty Power Compartment. Push the Battery into the empty Power Compartment until it locks (clicks) into position and is flush with the back of the device. When the Battery is properly installed and the Eclipse is ON, the Battery Status Gauge will appear on the Control Panel. (If you DO NOT have a Battery installed, the Power Cartridge Status Gauge will not illuminate).



To remove the Battery, pull DOWN on the black release lever. While holding DOWN the release lever, pull the Battery away from the Eclipse.

Battery Operating Times: The duration-of-use of the Battery is displayed at the top of the Control Panel. A variety of factors, such as flow setting, Pulse or Continuous Flow Mode and breath rate, will impact the operating time. The table on page 15 provides operating time ESTIMATES for the Eclipse using a new, fully charged Battery based on flow settings and operating conditions as indicated.

CAUTION

STORE IN A COOL AND DRY LOCATION TO HELP ENSURE THE LONGEVITY OF YOUR BATTERY.

INITIAL BATTERY CHARGING

The new Battery supplied with your Eclipse is not fully charged when it is shipped from the factory. Before using your Eclipse for the first time, you must first fully charge the Battery.

With the AC Power Supply plugged in, and the Battery correctly installed in the Power Compartment of the device, allow the Battery to completely charge. The Battery is fully charged when the Power Cartridge Status Gauge, on the Control Panel, is no longer cascading.

The Eclipse can be used while either discharging or recharging the Battery. It may take up to 5.0 hours, dependent upon the flow setting, to achieve 80% capacity from a fully discharged Battery.



Personal Ambulatory Oxygen System **Users Manual**

WARNING:

DO NOT TAMPER WITH, CRUSH, DISASSEMBLE, INCINERATE, OR HEAT THE BATTERY ABOVE 140° F (60° C). DOING SO WILL VOID THE WARRANTY. THE BATTERY MAY PRESENT A RISK OF FIRE, EXPLOSION OR CHEMICAL BURN IF MISTREATED.

CAUTION:

DO NOT LEAVE YOUR ECLIPSE, OR YOUR BATTERY, IN THE SEATING AREA OF YOUR MOTOR VEHICLE OR IN THE TRUNK OF YOUR MOTOR VEHICLE DURING A HOT DAY. NOTE: THE STORAGE TEMPERATURE RANGE FOR THE DEVICE IS -4°F (-20°C) TO +140°F (+60°C) AND 95% NON-CONDENSING HUMIDITY.

ONLY USE SEQUAL-PROVIDED BATTERIES.



*** Batteries are recyclable. ***

In the event of an AC or DC power interruption, the Eclipse will automatically switch to Battery operation, as long as the Battery is present and charged. When AC power is restored, the Battery will automatically start recharging, if not fully charged. If the Battery is not present, or fully discharged, during an AC power interruption, the Eclipse will shut down and alarm. The Battery is fully discharged when the Power Cartridge Status Gauge on the control panel, is no longer illuminated. The device will sound a low Battery alert until the device completely shuts down. This audible alert may continue for up to 5 minutes until the device shuts down.

NOTE: Press and hold the Eclipse ON/OFF button for a minimum of 5 seconds, to silence the Loss of Power alarm. Connecting the Eclipse to an external AC power supply for 2 minutes will also eliminate this alarm.

TYPICAL NEW POWER CARTRIDGE OPERATING TIMES

FLOW RATE SETTING	Continuous Flow (LPM)	mL SETTING	Pulse Dose Mode (12 BPM)
0.5	4.4 hours	-	-
1.0	3.7 hours	16mL 1.0	5.4 hours
2.0	2.0 hours	32mL 2.0	5.1 hours
3.0	1.3 hours	48mL 3.0	4.9 hours
		64mL 4.0	4.0 hours
		80mL 5.0	3.7 hours
		96mL 6.0	3.5 hours
		128mL	2.5 hours
		160mL	2.0 hours
		192mL	1.7 hours

NOTE: Battery times will decrease with higher bolus size, breath rate, ambient temperature, Battery age and use over time.

CAUTION:

U.S. DEPARTMENT OF TRANSPORTATION (DOT) AND UNITED NATIONS (UN) REGULATIONS REQUIRE THE REMOVAL OF BATTERY FROM THE DEVICE FOR ALL INTERNATIONAL AIRLINE TRAVEL WHEN THE ECLIPSE IS CHECKED AS LUGGAGE. WHEN SHIPPING THE ECLIPSE, THE BATTERY MUST ALSO BE REMOVED FROM THE DEVICE AND PACKAGED PROPERLY.

DO NOT ATTEMPT TO OPEN THE BATTERY, THERE ARE NO SERVICEABLE PARTS INSIDE THE BATTERY.

ONLY USE SEQUAL-PROVIDED BATTERIES.

RETURN THE BATTERY TO YOUR HOME CARE PROVIDER FOR PROPER DISPOSAL.

KEEP THE BATTERY AWAY FROM CHILDREN.

TYPICAL BATTERY RECHARGE TIME

The typical time to recharge your Battery, in order to achieve 80% capacity, from a fully discharged Battery is up to 5.0 hours, depending upon the device flow setting. When the battery is fully charged, the battery gauge will cease cascading.

If the Battery becomes too warm during discharging, recharging will not begin until the Battery sufficiently cools. Removing the Battery and allowing it to cool may expedite this cooling process.

The Battery may not recharge when operating from the DC Power Supply, depending on flow setting and temperature.

The Battery charges when in the device or with the optional Desktop Charger.

OPERATING YOUR ECLIPSE FOR THE FIRST TIME

Step 1: Positioning Your Eclipse for Use

Place the Eclipse in a well-ventilated, well lit area. Be sure the air inlet and exhaust vent are not obstructed.

Position the Eclipse so that all audible and visual indicators or alarms can be easily seen and heard.

Be sure the air inlet filter is in place before operating your Eclipse. If the air inlet filter is missing, contact your home care provider. If the air inlet filter is dirty, wash with warm soapy water, rinse with clear water and allow it to dry before placing the air inlet filter back in the device. If necessary, replace it with a new, clean air inlet filter.

Plug the device into a grounded AC Power outlet, a DC Power source, or be sure there is a fully charged Battery installed.



Step 2: Power ON the Device and Allow it to Warm-Up



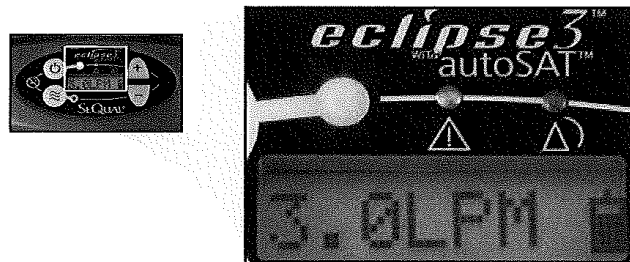
Press and hold the "ON/OFF" Button for two (2) seconds to power **ON** your Eclipse. A brief audible and visual power on self-test will occur. Verify that all the indicators are illuminated and that a buzzer sounds indicating the device is operating properly.

Personal Ambulatory Oxygen System **Users Manual**

NOTE: If there are three beeps, this indicates a low battery condition for the 9-volt battery inside the cabinet of the Eclipse. Please contact your home care provider and request that the 9-volt battery be replaced.

NOTE: Please allow longer warm up times for cold weather start-ups.

The Eclipse has an oxygen concentration status indicator (OCSI) built in to the device. The OCSI continually monitors the oxygen output of the device and incorporates a green light (normal), yellow light (alert), red light (alarm) and a buzzer. These indicators will all illuminate during the power on self-test at start-up. After initially powering ON the device, please allow up to five (5) minutes for the device to reach its performance specifications. When only the green indicator light is illuminated, the device has reached its performance specifications.



Step 3: Connect the Oxygen Supply Tubing, or Nasal Cannula to the Oxygen Outlet.

Replace the cannula and oxygen supply tubing regularly, as recommended by your home care provider. Consult your home care provider for cannula and supply tubing cleaning and replacement information.

Step 4: Select the Flow Mode



Press the Flow Mode button to select the desired mode. Pressing this button repeatedly will toggle you back and forth between Pulse Dose Mode and Continuous Flow Mode. The proper mode and proper setting should be prescribed for you by your physician.

CONTINUOUS FLOW MODE OPERATION:

When operating in the Continuous Flow Mode, a continuous supply of oxygen measured in liters per minute (LPM) will flow through your tubing and nasal cannula.

PULSE DOSE MODE OPERATION:

When operating in Pulse Mode, a bolus of oxygen, measured in milliliters (mL), is delivered upon inspiration. DO NOT use a humidifier in the Pulse Dose Mode.

Secure a prescription for pulse dose from your physician with consideration to your needs at rest, during exercise and when traveling at altitude.

When operating in pulse dose mode, the Eclipse 3 supplies a continuous flow of oxygen when a breath is not detected. The device will continually check for an inspiratory effort every 15 seconds. Once an inspiration is detected, the device reverts to measured bolus delivery. To exit Pulse Dose Mode and engage Continuous Flow Mode, push the flow mode button.

PULSE DOSE MODE AND autoSAT FEATURES

Your Eclipse has a feature, called autoSAT® that delivers a consistent-sized bolus of oxygen up to 40 breaths per minute (see max breath rate chart below). As your breath rate increases, ie. during ambulation, the autoSAT feature servo-controls the device delivering the set bolus size. autoSAT Technology is proprietary to SeQual and is utilized during Pulse Mode only.

BOLUS VOLUME (+/- 15%)	Pulse Dose Setting	Bolus Size (± 15%) mL	AC Power Supply and Power Cartridge (Battery)	DC Power Supply
			Max Breath Rate	Max Breath Rate
	1.0	16	40	40
	2.0	32	40	40
	3.0	48	40	40
	4.0	64	40	31
	5.0	80	37	25
	6.0	96	31	20
	-	128	23	15
	-	160	18	12
	-	192	15	10

NOTE: Bolus volume decreases as breath rate exceeds published range.

WARNING

DO NOT USE SUPPLY TUBING OR CANNULA EXTENSIONS THAT ARE MORE THAN 50' (15.2M) IN LENGTH IN THE CONTINUOUS FLOW MODE.

PULSE DOSE MODE SETTINGS MUST BE DETERMINED FOR EACH PATIENT INDIVIDUALLY FOR THEIR NEEDS AT REST, DURING EXERCISE AND WHEN TRAVELING.

DO NOT EXCEED 7 FEET (2.1M) IN LENGTH OF SUPPLY TUBING OR CANNULA TUBING WHEN OPERATING IN PULSE DOSE MODE IN ORDER TO ADEQUATELY DETECT ADEQUATE INSPIRATORY EFFORT.

AS WITH ALL OXYGEN-CONSERVING TYPE DEVICES, THE ECLIPSE MAY NOT BE ABLE TO DETECT ALL INSPIRATORY EFFORTS IN PULSE MODE. IF THE ECLIPSE DOES NOT RESPOND TO YOUR INSPIRATION EFFORTS, ASK YOUR HOME CARE PROVIDER TO CHECK THE SENSITIVITY SETTING.

Step 5: ADJUST THE FLOW SETTING TO THE PRESCRIBED LEVEL



Using the **Flow Setting Buttons**, adjust the flow setting to the prescribed setting supplied by your physician.

WARNING

DO NOT CHANGE FROM PRESCRIBED FLOW SETTING WITHOUT CONSULTING WITH A QUALIFIED CLINICIAN OR PHYSICIAN.



Personal Ambulatory Oxygen System **Users Manual**

Step 6: Begin Using Your Eclipse

Breathe normally through the nasal cannula.

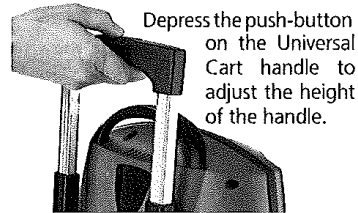
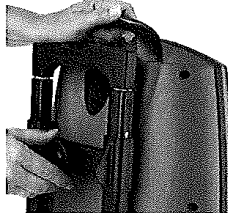
NOTE: You will achieve longer operating time on the Battery if you operate your Eclipse in the Pulse Mode.

Step 7: Universal Cart Operation

The Universal Cart is designed for use on pedestrian-type surfaces.

Align the locator holes on the bottom of the device to the tabs on the Universal Cart.

Align the large threaded screw to the insert at the back of the Eclipse. Then hand-tighten the knob on the cart until the Universal Cart is tightly secured to the device.



Step 8: Power Off the Device



Press and hold the "ON/OFF" Button for two (2) seconds to power OFF your Eclipse.

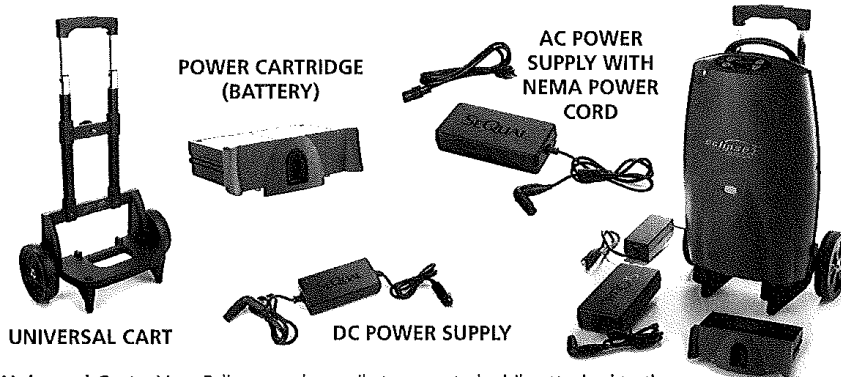
Store the Eclipse in a cool and dry location.

NOTE: DO NOT operate your Eclipse and ambulate while a humidifier is attached. Remove the humidifier bottle before walking. DO NOT lay the Eclipse down while attached to a humidifier bottle.

Eclipse Standard Components (Supplied with each Eclipse)

WARNING:

ONLY USE SEQUAL RECOMMENDED ACCESSORIES. OTHERS MAY IMPAIR PERFORMANCE.



Universal Cart – Your Eclipse can be easily transported while attached to the Universal Cart. The Universal Cart features wheels and a telescoping handle to aid mobility.

WARNING:

A BACK-UP SOURCE OF SUPPLEMENTAL OXYGEN IS RECOMMENDED IN CASE OF A POWER OUTAGE OR A MECHANICAL FAILURE OF THE DEVICE. CONSULT YOUR PROVIDER FOR A BACK-UP SOURCE OF OXYGEN.

TROUBLESHOOTING TABLE DO NOT IGNORE ALARMS.

SYMPTOM	PROBABLE CAUSE	REMEDY
Eclipse does not power on when ON/OFF button is pressed	No Battery Installed	Install Battery or plug into external power
	Battery is discharged or no external power is present	Plug into external power
	AC or DC Power Supply is not plugged in correctly	Check plug at outlet, Power Supply box and at the Eclipse to ensure properly plugged in.
	Insufficient power from the outlet	Ensure there is adequate power from the outlet. (Outlet may be controlled by a wall switch or the circuit breaker may have engaged.)
	Other	Contact your dealer/provider
No Oxygen	Filter Blocked	Clean Air Inlet Filter
	Humidifier	Check humidifier attachment and tubing
	Eclipse not ON	Power Eclipse ON
	Tubing or cannula is not properly connected or kinked	Check tubing, cannula and connections
	Other	Contact your dealer/provider
Low Oxygen Concentration	Restriction in tubing or humidifier	Repair or replace tubing or humidifier. Place your Eclipse so there is adequate air flow.
	Filter restricted	Clean or replace air inlet filter. Place your Eclipse so there is adequate air flow.
	Exceeding maximum breath rate in Pulse Mode. *See Pulse Dose Mode Breath Rate Chart (p. 18)	Switch to Continuous Flow Mode until respiratory rate resumes to an acceptable rate.
	Other	Contact your dealer/provider
Low Oxygen Flow	Restriction in humidifier or tubing	Repair or replace humidifier or tubing
	Filter Blocked	Clean or replace air inlet filter
	Other	Contact your dealer/provider
No Oxygen Delivered in Pulse Flow Mode	Tubing/cannula longer than 7 feet (2.1m)	Attach 7 foot (2.1m) tubing/cannula
	Humidifier attached	Remove humidifier
	No inspiration detected	Contact your dealer/provider
	Unit in Continuous Mode	Switch to Pulse Mode
	Nasal cannula not in the nose or mouth breathing	Place nasal cannula in nostrils and breath through your nose
Power Cartridge Status Gauge never indicates fully charged	Power Cartridge (Battery) is aging	Contact your dealer/provider to replace Power Cartridge (Battery)

CLEANING, CARE AND ROUTINE MAINTENANCE

Routine Maintenance

Servicing of the internal components inside the cabinet of the Eclipse must be conducted by a SeQual trained and qualified service technician as needed.

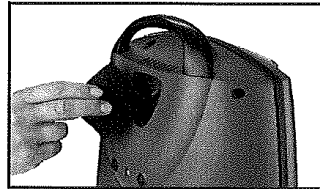
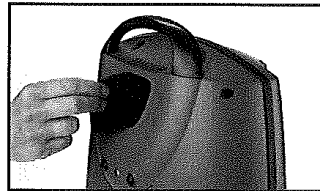
Preventative Maintenance (PM) should be completed on a regular basis. Consult your provider to arrange PM schedule. Your home care provider or qualified technician will perform inspections and maintenance of the compressor, alarms, internal 9-volt battery, battery and other internal parts only as needed.

User Care and Cleaning of the Device

Cannula Replacement: Replace your supply tubing and cannula on a regular basis as recommended by your home care provider. Your physician or home care provider will provide you with cleaning, disinfection and replacement information.

Air Inlet Filter: Ambient air is drawn into the device through the air inlet located on the top rear of the device. Cleaning the air inlet filter is the most important maintenance activity you will perform as a user, cleaning the air inlet filter will keep your Eclipse performing properly. Check this air inlet filter daily and clean it at least once a week using the following procedure:

1. Remove the air inlet filter;
2. Wash the filter in warm tap water using a mild soap detergent solution;
3. Rinse the filter thoroughly with clear tap water and squeeze out the excess water;
4. Allow the filter to air dry;
5. Reinsert the filter in the cabinet;



Cleaning tip - keep a clean second filter as a replacement for use when one filter is drying.

CAUTION:

THE AIR INLET FILTER SHOULD BE FREE OF LIQUID WATER AND DRY TO THE TOUCH BEFORE REINSTALLATION. MOISTURE IN THE FILTER MAY IMPAIR PROPER OPERATION OF THE ECLIPSE.

NOTE THAT THE SERVICE PORT IS EXPOSED (WHEN THE AIR INLET FILTER IS REMOVED). **DO NOT** ATTACH ANY CABLES TO THIS SERVICE PORT. THE PART IS TO BE USED BY A QUALIFIED SERVICE TECHNICIAN ONLY.

DO NOT PLACE FOREIGN OBJECTS INTO OR THROUGH THE VENT HOLES OF THE AIR INLET OR EXHAUST VENT.

Oxygen Delivery Devices:

Oxygen Cylinders





Oxygen Cylinders

Instruction Check Sheet

Demonstrate:

- _____ How to set up all oxygen devices on resident
- _____ Proper set up of humidifier bottle with oxygen devices- show common leak areas
- _____ How to change regulator on O2 cylinders
- _____ How to read gauges

Explain:

- _____ Safe storage of O2 cylinders
- _____ Safe handling of O2 cylinders

Nurse: _____

Instructor: _____

Date: _____

Oxygen Cylinders

Overview

1. Before connecting equipment to a cylinder, be certain that the connections are free of foreign materials.
2. Turn valve outlet away from personnel and crack cylinder valve to remove any dust or debris from cylinder valve.
3. Outlets and connections must be tightened with only appropriate wrenches and must never be forced on.
4. Regulators should be turned off as cylinder is turned on, and the cylinder valve should be opened slowly.
5. Cylinder valves should be closed at all times except when they are in use.
6. Never lubricate valve outlets or connecting equipment (oxygen and oil under pressure causes an explosive oxidation reaction).
7. Cylinder valves should be closed at all times, except when they are in use.



Oxygen Cylinders

Operation Instructions

Small Cylinder

1. Open the cylinder by turning the cylinder valve handle counter clockwise (left) all the way. (Large round handle directly on top of tank).
2. The contents/pressure gauge will register the amount of oxygen in the cylinder (a full cylinder registers approximately 2200 psi).
3. Adjust the flow control knob until the flow indicator is at the prescribed flow rate. (flow control knob located directly on tank regulator. This is where oxygen tubing attaches).
4. Fit the cannula to your face so that it is comfortable.
5. When not using the oxygen, remove your cannula. Close the cylinder by turning the valve handle clockwise all the way.
6. The flow of gas will cease when all the oxygen pressure is released from the regulator. Both gauge indicators will read 0.
7. Turn the flow control knob off.

Large Cylinder

1. Open the cylinder by turning the cylinder valve handle counter clockwise (left) all the way. (Large round handle directly on top of tank).
2. The contents/pressure gauge will register the amount of oxygen in the cylinder (a full cylinder registers approximately 2200 psi).
3. Adjust the flow control knob until the flow indicator is at the prescribed flow rate. (flow control knob located directly on tank regulator. This is where oxygen tubing attaches).
4. Fit the cannula to your face so that it is comfortable.
5. When not using the oxygen, remove your cannula. Close the cylinder by turning the valve handle clockwise all the way.
6. The flow of gas will cease when all the oxygen pressure is released from the regulator. Both gauge indicators will read 0.
7. Turn the flow control knob off.

Oxygen Cylinders

Storage and Transportation

Storage

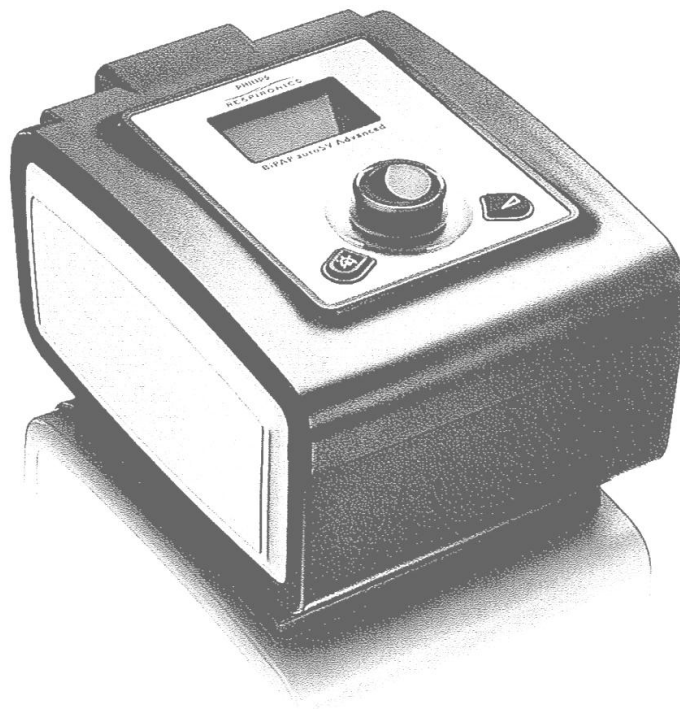
- The temperature of the room must not exceed 125 degrees Fahrenheit
- Storage rooms must be dry, cool, and well ventilated.
- Cylinders must not be stored near flammable substances.
- Large cylinders must be stored in an upright position.
- Valves should be kept closed on empty cylinders at all times.
- Cylinders must be stored with their protective caps in place.

Transportation

- Protective caps should be used whenever cylinders are in transport until they are ready for use.
- Cylinders must not be dragged, slid, dropped or allowed to strike each other violently.
- Cylinders must be transported on an appropriate cart secured by a chain or strap.
- A NO SMOKING sign must be posted where the oxygen is administered. It must be legible from a distance of five feet and must be displayed in a conspicuous location.
- Cylinders must not be handled with oily or greasy hands, gloves, or clothing.
- Inform all occupants of the area of the hazards of smoking and of the regulations.

BiPAP/CPAP Devices:

BiPAP/CPAP Machines





BiPAP/CPAP Machines Instruction Check Sheet

Demonstrate:

- _____ How to set up BIPAP/CPAP on resident
- _____ Proper set up with Humidification
- _____ Proper set up with oxygen
- _____ Circuit changes
- _____ Proper cleaning of mask assembly/head gear and nasal pillows
- _____ Setting changes: IPAP/EPAP/Model/BIPAP

Explain:

- _____ Indication of CPAP/BIPAP
- _____ Need for Humidification

Nurse: _____

Instructor: _____

Date: _____

BiPAP/CPAP Machines

Overview

1. **CPAP** = Continuous Positive Airway Pressure
2. **BIPAP**= Bilevel Positive Airway Pressure
3. CPAP and BIPAP machines are both used to provide positive pressure to the patient's airways.

There are generally two indications for CPAP/BIPAP therapy:

- a. Patients with Obstructive Sleep Apnea use CPAP/BIPAP to force air through their obstructed upper airways. While they sleep, their throat closes in and prevents air from getting into their lungs. This causes their oxygen saturation to drop and their carbon dioxide to rise. Their body will instinctively cause them to gasp and open their airways. Without proper ventilation, the body does not get the right "REM" sleep and this can result in sleeplessness during the day and other medical problems. While using the CPAP/BIPAP machine, the positive pressure prevents the airway from collapsing and the patient is able to breathe properly. A patient gets an overnight sleep study done to determine the proper CPAP/BIPAP pressure needed to prevent airway collapse. These patients do not have problems with their lungs, only their upper airways.
 - b. Some patients require BIPAP to boost air into their lungs, and assist them to breathe more deeply and more easily. In this way the BIPAP is used as a non-invasive ventilator. BIPAP is used instead of CPAP because the inspiratory pressure needed to assist them to breathe is fairly high and it would be difficult to exhale against that pressure. The inspiratory pressure is set high and the expiratory pressure is generally very low. Some BIPAP machines have respiratory rate that can be dialed in to trigger a breath a number of times per minute. The types of patients who use BIPAP in this way are COPD patients or patients with musculoskeletal problems like quadriplegics and patients with Muscular Dystrophy.
4. There are several different types masks and headgears to administer the CPAP/BIPAP therapy. Each patient is different so different mask sizes and types are available to suit the patient's needs. The masks used either only cover the nose or cover both the nose and mouth. There is also an item called nasal pillows that fit directly into the nose instead of the mask is the patient is unable to tolerate the mask. Masks come in small, medium and large.



BiPAP/CPAP Machines

Instructions

1. Pull the thin clear tubing off of the main tubing-you won't be using it.
2. At the top of the circuit is a port with a white cap. If the patient is not using oxygen close the port with the cap.
3. If the patient requires oxygen to be bled into the circuit, bleed it in here. Cut off one end of the oxygen tubing and place it here. Attach the other end of the tubing to the oxygen source.
4. Attach the end of the CPAP/BIPAP circuit with the white cap directly to the patient's mask. The other end of the circuit attaches to the CPAP/BIPAP machine. There is also a small hole at this end of the circuit. This is the exhalation port-this is where the patient exhales-this should never be covered up. It is normal to feel a constant flow of air escaping from the exhalation port while the patient is using the CPAP/BIPAP. Try to face this hole away from the patient so that it does not blow on the patient.
5. When setting the patient up on nasal pillows or mask make sure that there are no leaks. Adjust the headgear so that the mask or nasal pillows fit snugly on the patient's face.
6. Wash the mask or nasal pillows every morning.
7. Change the circuit once a week

HELPFUL HINTS:

- When you use Nasal CPAP for the first time you will note an unusual sense of pressure when breathing. You will need to consciously push out when you breathe out. This is normal and will occur automatically when you are asleep. At first, you may feel that the pressure is impeding your breathing. It is not. Take your time and learn to adapt to this new sensation. A few deep breaths at the start of use may help to minimize the sensation.
- If you open your mouth, air will leak out. This is an unpleasant sensation. While wearing your mask when you are awake, you should keep your mouth closed. When you are asleep this usually happens automatically. However, if you awake at night and open your mouth, the sensation of air rushing from your mouth might alarm you at first. You should close your mouth and try to go back to sleep.
- Some people experience a continuing dryness of the nose, mouth or throat when on nasal CPAP, particularly during the winter months. This may be relieved by the use of an "in-line" humidifier, such as a hygroscopic condenser humidifier (HCH) or a heated humidifier, both of which are available. Contact your physician or equipment supplier for specific advice on whether these are suitable for you. Also note that your set pressure may need to be adjusted if a humidifier is used.

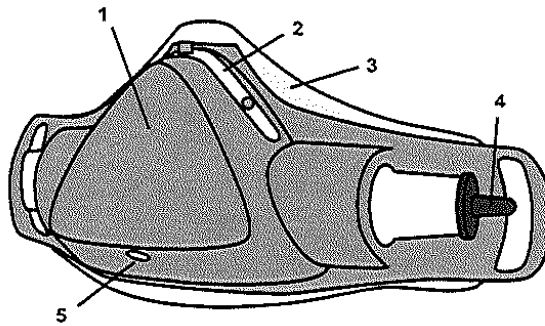
Note: In-line humidifiers should never be used at the same time as nebulized drugs or when nose sprays are used.

- Washing your face to remove excess facial oils prior to fitting the mask will help prolong the useful life of the cushion.
- A tight fit of the mask is not necessary. A well balanced, comfortable fit without undue tightness can usually be obtained to provide an efficient air seal. Pulling the straps too tight can lead to sensitivity of the bridge of the nose or the upper lip, and occasionally skin irritation. Setting the final tension is best done while lying down.

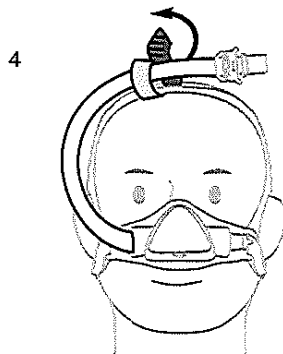
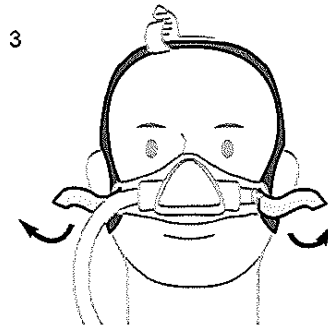
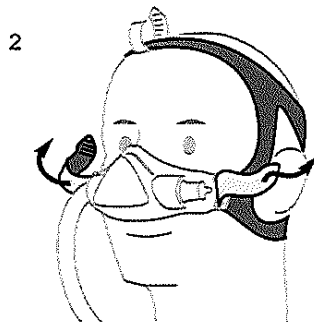
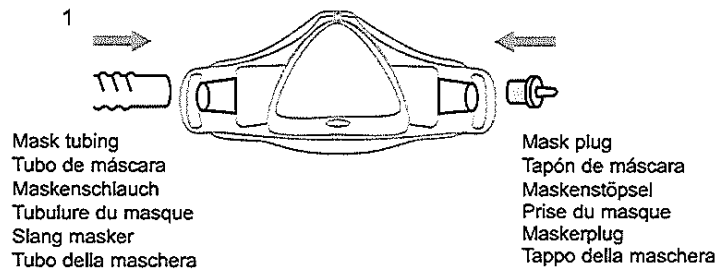
Note: A minor leak around the lower part of the face is sometimes preferable to over-tightening the mask, but you should eliminate any air leaks blowing in the direction of the eyes as this may cause eye irritation.

BiPAP/CPAP Machines
Operators Manual

Sleepnet Phantom Nasal Mask



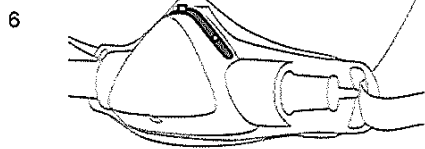
*The following is an excerpt from Sleepnet Phantom Nasal Mask
User Manual*



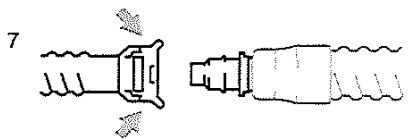


Mask tubing
 Tubo de máscara
 Maskenschlauch
 Tubulure du masque
 Slang masker
 Tubo della maschera

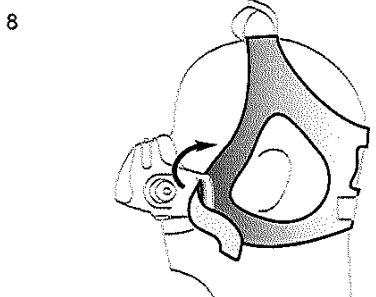
CPAP tubing
 Tubo de CPAP
 CPAP-Schlauch
 Tubulure de l'appareil de
 pression positive expiratoire
 CPAP slang
 Dispositivo CPAP

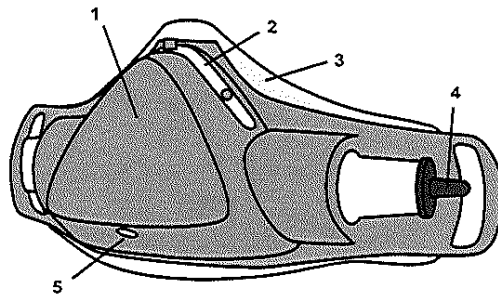


Nose clip
 Clip de nariz
 Nasenklemme
 Pince-nez
 Neusklem
 Clip naso



Squeeze
 Presionar
 Zusammendrücken
 Pincer
 Indrukken
 Premere





- | | |
|----------------------------|-------------------------------|
| 1. Mask Shell | 1. Coque du masque |
| 2. Nose Clip | 2. Pince-nez |
| 3. Gel Cushion | 3. Coussinet rempli de gel |
| 4. Mask Plug | 4. Prise du masque |
| 5. Exhaust Hole | 5. Orifice d'évacuation d'air |
| | |
| 1. Carcasa de la máscara | 1. Gelaatstuk |
| 2. Clip de nariz | 2. Neusklem |
| 3. Acolchado de gel | 3. Gelkussen |
| 4. Tapón de máscara | 4. Maskerplug |
| 5. Orificio de ventilación | 5. Uitlaatgat |
| | |
| 1. Maskenaußenhülle | 1. Guscio della maschera |
| 2. Nasenklamme | 2. Clip naso |
| 3. Gel-Kissen | 3. Cuscinetto in gel |
| 4. Maskenstöpsel | 4. Tappo della maschera |
| 5. Entlüftungslöcher | 5. Foro di sfogo |

VENT HOLE PRESSURE/FLOW CHARACTERISTICS (Approx.)

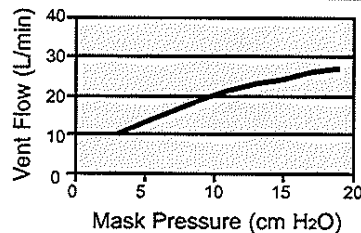
CARACTERÍSTICAS DE PRESIÓN/FLUJO DEL ORIFICIO DE VENTILACIÓN (APROX.)

ENTLÜFTUNGSLOCHDRUCK / FLIESSVERHALTEN (ungefähr)

CARACTÉRISTIQUES DE PRESSION/DÉBIT DES ORIFICES D'ÉVACUATION (approx.)

VENTILATIEOPENINGEN DRUK-/STROMINGSEIGENSCHAPPEN (bij benadering)

CARATTERISTICHE PRESSIONE/FLUSSO FORO DI SFOGO (Appross.)



Vent Flow (L/min)

Flujo de ventilación

Entlüftungsrate

Débit d'évacuation

Ventilatiestroming

Flusso foro di sfogo

Mask Pressure (cm H₂O)

Presión de la máscara

Maskendruck

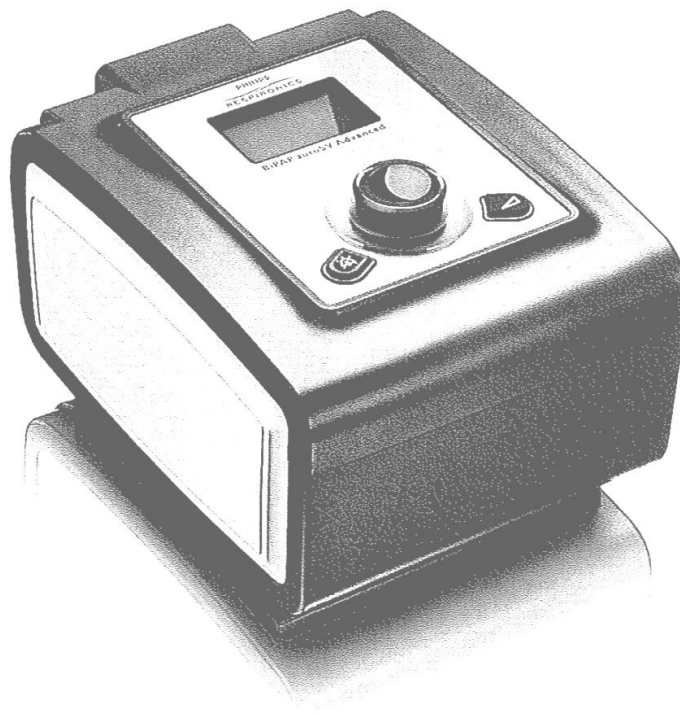
Pression du masque

Maskerdruck

Pressione maschera

BiPAP/CPAP Machines
Operators Manual

Philips Respironics BiPAP/CPAP System



*The following is an excerpt from Respironics System One User
Manual*

CAUTION: U. S. federal law restricts this device to sale by or on the order of a physician.

Intended Use

The BiPAP autoSV Advanced System One is intended to provide non-invasive ventilatory support to treat adult patients (>30 kg/66 lbs) with Obstructive Sleep Apnea and Respiratory Insufficiency caused by central and/or mixed apneas and periodic breathing. This device may be used in the hospital or home.

Warnings

A warning indicates the possibility of injury to the user or the operator.

- This manual serves as a reference. The instructions in this manual are not intended to supersede the health care professional's instructions regarding the use of the device.
- The operator should read and understand this entire manual before using the device.
- This device is not intended for life support.
- The device should be used only with masks and connectors recommended by Respironics or with those recommended by the health care professional or respiratory therapist. A mask should not be used unless the device is turned on and operating properly. The exhalation port(s) or entrainment valve associated with the mask should never be blocked. **Explanation of the Warning:** The device is intended to be used with special masks or connectors that have exhalation ports to allow continuous flow of air out of the mask. When the device is turned on and functioning properly, new air from the device flushes the exhaled air out through the mask exhalation port or entrainment valve. However, when the device is not operating, enough fresh air will not be provided through the mask, and exhaled air may be rebreathed. Rebreathing of exhaled air for longer than several minutes can in some circumstances lead to suffocation.
- When using oxygen with this system, a Respironics Pressure Valve must be placed in-line with the patient circuit between the device and the oxygen source. The pressure valve helps prevent the backflow of oxygen from the patient circuit into the device when the unit is off. Failure to use the pressure valve could result in a fire hazard.
- When using oxygen with this system, turn the device on before turning on the oxygen. Turn the oxygen off before turning the device off. This will prevent oxygen accumulation in the device. **Explanation of the Warning:** When the device is not in operation and the oxygen flow is left on, oxygen delivered into the tubing may accumulate within the device's enclosure. Oxygen accumulated in the device enclosure will create a risk of fire.
- Oxygen supports combustion. Oxygen should not be used while smoking or in the presence of an open flame.
- When using oxygen with this system, the oxygen supply must comply with local regulations for medical oxygen.
- Do not connect the device to an unregulated or high pressure oxygen source.
- Do not use the device near a source of toxic or harmful vapors.
- Do not use this device if the room temperature is warmer than 35° C (95° F). If the device is used at room temperatures warmer than 35° C (95° F), the temperature of the airflow may exceed 43° C (109° F). This could cause irritation or injury to your airway.
- Do not operate the device in direct sunlight or near a heating appliance because these conditions can increase the temperature of the air coming out of the device.
- If you notice any unexplained changes in the performance of this device, if it is making unusual or harsh sounds, if it has been dropped or mishandled, if water is spilled into the enclosure, or if the enclosure is broken, disconnect the power cord and discontinue use. Contact your home care provider.
- Periodically inspect electrical cords and cables for damage or signs of wear. Discontinue use and replace if damaged.
- To avoid electrical shock, always unplug the power cord from the wall outlet before cleaning the device. DO NOT immerse the device in any fluids.
- If the device is used by multiple persons (such as rental devices), a low-resistance, main flow bacteria filter should be installed in-line between the device and the circuit tubing to prevent contamination.
- The BiPAP autoSV Advanced System One device can deliver pressures up to 25 cm H₂O. In the unlikely event of certain fault conditions, pressures of up to 35 cm H₂O are possible.
- The data obtained when using an Oximetry module accessory is not considered to be diagnostic and is not to be used in the diagnosis of a patient's condition.

Note: Please see the "Limited Warranty" section of this manual for information on warranty coverage.

Cautions

A Caution indicates the possibility of damage to the device.

- Pins of connectors should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. Precautionary procedures include methods to prevent build-up of electrostatic charge (e.g., air conditioning, humidification, conductive floor coverings, non-synthetic clothing), discharging one's body to the frame of the equipment or system or to earth or a large metal object, and bonding oneself by means of a wrist strap to the equipment or system or to earth.

- Before operating the device, ensure that the SD card cover is replaced whenever any of the accessories such as the Link Module or Modem are not installed. Refer to the instructions that came with your accessory.
- Condensation may damage the device. If this device has been exposed to either very hot or very cold temperatures, allow it to adjust to room temperature (operating temperature) before starting therapy. Do not operate the device outside of the operating temperature range shown in the Specifications.
- Do not use the device in the presence of a flammable anaesthetic mixture in combination with oxygen or air, or in the presence of nitrous oxide.
- Do not use extension cords with this device.
- Do not place the device directly onto carpet, fabric, or other flammable materials.
- Do not place the device in or on any container that can collect or hold water.
- A properly installed, undamaged reusable foam inlet filter is required for proper operation.
- Tobacco smoke may cause tar build-up within the device, which may result in the device malfunctioning.
- Dirty inlet filters may cause high operating temperatures that may affect device performance. Regularly examine the inlet filters as needed for integrity and cleanliness.
- Never install a wet filter into the device. You must ensure sufficient drying time for the cleaned filter.
- When using the bacteria filter, the device performance may be affected. However, the device will remain functional and deliver therapy.
- When DC power is obtained from a vehicle battery, the device should not be used while the vehicle's engine is running. Damage to the device may occur.
- Only use a Respiroics DC Power Cord and Battery Adapter Cable. Use of any other system may cause damage to the device.
- Repairs and adjustments must be performed by Respiroics-authorized service personnel only. Unauthorized service could cause injury, invalidate the warranty, or result in costly damage.

Contraindications

The device should not be used if you have severe respiratory failure without a spontaneous respiratory drive.

If any of the following conditions apply to you, consult your physician before using the device:

- Inability to maintain an open airway or adequately clear secretions
- At risk for aspiration of gastric contents
- Diagnosed with acute sinusitis or otitis media
- Allergy or hypersensitivity to the mask materials where the risk from allergic reaction outweighs the benefit of ventilatory assistance
- Epistaxis, causing pulmonary aspiration of blood
- Hypotension

Patient Precautions

- Immediately report any unusual chest discomfort, shortness of breath, or severe headache.
- If skin irritation or breakdown develops from the use of the mask, refer to the mask instructions for appropriate action.
- The following are potential side effects of noninvasive positive pressure therapy:
 - Ear discomfort
 - Conjunctivitis
 - Skin abrasions due to noninvasive interfaces
 - Gastric distention (aerophagia)
- Contact your health care professional if symptoms of sleep apnea recur.

Symbol Key

The following symbols may appear on the device and power supply:

SYMBOL	DEFINITION	SYMBOL	DEFINITION
	Consult accompanying instructions for use.		Do not disassemble.
	For Airline Use. Complies with RTCA/DO-160F section 21, category M.		Separate collection for electrical and electronic equipment per EC Directive 2002/96/EC.
	DC Power		Class II (Double Insulated)
	Type BF Applied Part		For Indoor Use Only.
IPX1	Drip Proof Equipment		

System Contents

Your BiPAP autoSV Advanced System One includes the following items:

- Device
- User manual
- Carrying case
- Reusable gray foam filter
- Disposable ultra-fine filter
- Flexible tubing, 22 mm (optional 15 mm tubing is also available)
- Power cord and power supply (Part# 1058190)
- Side cover panel
- SD card
- Humidifier (optional)

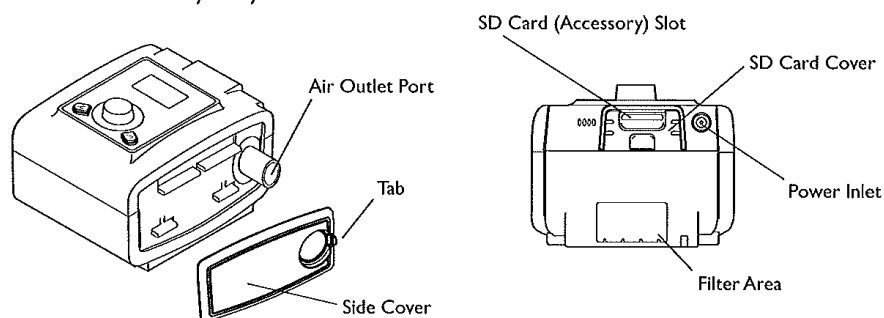
Note: If any of these items are missing, contact your home care provider.

System Overview

The BiPAP autoSV Advanced System One device is intended to augment your breathing by supplying pressurized air through a circuit. It senses the your breathing effort by monitoring airflow in the circuit and adjusts its output to assist in inhalation and exhalation. This therapy is known as Bi-level ventilation. Bi-level ventilation provides a higher pressure, known as IPAP (Inspiratory Positive Airway Pressure), when you inhale, and a lower pressure, known as EPAP (Expiratory Positive Airway Pressure), when you exhale. The higher pressure makes it easier for you to inhale, and the lower pressure makes it easier for you to exhale.

When prescribed, the device can also provide features to help make your therapy more comfortable. The ramp function allows you to lower the pressure when trying to fall asleep. The air pressure will gradually increase until the prescription pressure is reached. Additionally, the Bi-Flex comfort feature provides increased pressure relief during the expiratory phase of breathing.

Several accessories are also available for use with the device. Contact your home care provider to purchase any accessories not included with your system.



This figure illustrates some of the device features, described in the following table.

DEVICE FEATURE	DESCRIPTION
Air Outlet Port (conical, 22 mm)	Connect the flexible tubing here.
SD Card (Accessory) Slot	If applicable, insert the optional accessory SD card here.
SD Card Cover	If applicable, the optional accessories such as a Link Module or Modem can be installed here. Refer to the instructions supplied with the accessory. When not using an accessory, this cover must be in place on the device.
Power Inlet	Connect the power cord here.
Filter Area	A reusable, gray foam filter must be placed in the filter area to screen out normal household dust and pollens. A white ultra-fine filter can also be used for more complete filtration of very fine particles.
Side Cover	If using a humidifier with the device, this side cover can be easily removed with the release tab before attaching the humidifier. Refer to the humidifier manual. When not using a humidifier, this cover must be in place on the device.

Installing the Air Filters

CAUTION: A properly installed, undamaged gray foam filter is required for proper operation. The device uses a gray foam filter that is washable and reusable, and an optional white ultra-fine filter that is disposable. The reusable filter screens out normal household dust and pollens, while the ultra-fine filter provides more complete filtration of very fine particles.

The reusable gray foam filter and the optional disposable ultra-fine filter are supplied with the device. If your filters are not already installed when you receive your device, you must at least install the reusable gray foam filter before using the device. To install the filter(s):

1. If you are using the white disposable ultra-fine filter, insert it into the filter area first, mesh-side facing in, towards the device.
2. Insert the required gray foam filter into the filter area after the ultra-fine filter.

Note: If you are not using the white disposable filter, simply insert the gray foam filter into the filter area.

Connecting the Breathing Circuit

To use the system, you will need the following accessories in order to assemble the recommended circuit:

- Respironics interface (nasal mask or full face mask) with integrated exhalation port or entrainment valve, or Respironics interface with a separate exhalation device (such as the Whisper Swivel II)
- Respironics 22 mm flexible tubing, 1.83 m (6 ft.) (or optional Respironics 15 mm tubing)
- Respironics headgear (for the mask)

WARNING: If the device is used by multiple persons (such as rental devices), a low-resistance, main flow bacteria filter should be installed in-line between the device and the circuit tubing to prevent contamination.

To connect your breathing circuit to the device, complete the following steps:

1. Connect the flexible tubing to the air outlet on the side of the device. If you are using the optional Respironics 15 mm tubing, the device tubing type setting must be set to 15. If your device does not have the tubing type setting, you must use the Respironics 22 mm tubing.

Note: If required, connect a bacteria filter to the device air outlet, and then connect the flexible tubing to the outlet of the bacteria filter.

CAUTION: When using the bacteria filter, the device performance may be affected. However, the device will remain functional and deliver therapy.

2. Connect the tubing to the mask. Refer to the instructions that came with your mask.
3. Attach the headgear to the mask if necessary. Refer to the instructions that came with your headgear.

Where to Place the Device

Place the device on a firm, flat surface somewhere within easy reach of where you will use it at a level lower than your sleeping position. Make sure the filter area on the back of the device is not blocked by bedding, curtains, or other items. Air must flow freely around the device for the system to work properly. Make sure the device is away from any heating or cooling equipment (e.g., forced air vents, radiators, air conditioners).

CAUTION: Do not place the device directly onto carpet, fabric, or other flammable materials.

CAUTION: Do not place the device in or on any container that can collect or hold water.

Supplying AC Power to the Device

IMPORTANT: If you are using your device with a humidifier, refer to the instructions included with your humidifier for details on how to power the device and humidifier.

Complete the following steps to operate the device using AC power:

1. Plug the socket end of the AC power cord (included) into the power supply (also included).
2. Plug the pronged end of the AC power cord into an electrical outlet that is not controlled by a wall switch.
3. Plug the power supply cord's connector into the power inlet on the back of the device.
4. Ensure that all connections are secure.

IMPORTANT: To remove AC power, disconnect the power supply cord from the electrical outlet.

WARNING: Periodically inspect electrical cords and cables for damage or signs of wear. Discontinue use and replace if damaged.

CAUTION: Do not use extension cords with this device.

Navigating the Device Screens

Turn the wheel to toggle between options and settings on the screen. Press the wheel to choose an option or setting that is highlighted. If you choose "Back" on any screen, it will take you back to the previous screen.

Note: The screens shown throughout this manual are examples only. Actual screens may vary slightly. Examples are for reference only.

Starting the Device

1. Supply power to the device.
2. The Home screen will appear, shown below.

Therapy	Bi-Flex
 Info	Setup

Home Screen

Note: "Bi-Flex" shown above will either display a blank screen or it will show "Bi-Flex" or "Rise time" depending on how the provider set up the device.

Note: The SD card icon will display next to "Info", if the SD card is inserted.

3. Put on your mask assembly.

Note: If you are having trouble with your mask, refer to the instructions supplied with the mask.

4. Turn the wheel to toggle between the options. Highlight "Therapy". Press the wheel to turn on the airflow and begin therapy. The Monitor Pressure screen will appear, described in detail in the next section.

Note: If the "Auto on" feature is enabled, the device will automatically turn the airflow on whenever you apply the interface (mask) to your airway and begin to breathe into the interface.

5. Verify that the device beeps each time therapy is started. If the device does not operate accordingly, contact your home care provider, as the alarm system may not be fully functional.
6. Make sure that no air is leaking from your mask into your eyes. If necessary, adjust the mask and headgear until the air leak stops. See the instructions provided with your mask for more information.
Note: A small amount of mask leak is normal and acceptable. Correct large mask leaks or eye irritation from an air leak as soon as possible.
7. If you are using the device in a bed with a headboard, try placing the tubing over the headboard. This may reduce tension on the mask.
8. From the Home Screen, highlight "Therapy" then press and hold the Wheel for approximately 2 seconds to turn off therapy. Or, from the Monitor Pressure screen, press and hold the Wheel for approximately 2 seconds to turn off therapy and return to the Home Screen.
9. Verify that the device beeps when therapy is stopped. If the device does not operate accordingly, contact your home care provider, as the alarm system may not be fully functional.

Alert Audible Indicators

An audible indicator sounds whenever a power failure or a high, medium, or low priority alarm is detected. Additionally, an audible indicator sounds for informational messages and to confirm that certain actions have occurred (for example, when an SD card is inserted or removed from the device).

- **Device Inoperative** - When a device inoperative alarm occurs, a continuous audible indicator sounds. The alarm descriptions later in this manual display this indicator as: 
- **Power Failure** - When a power failure occurs, a series of beeps sounds in a 1 beep pattern, repeating one second on, then one second off. The alarm descriptions later in this manual display this indicator as: • • •
- **High Priority** - When a high priority alarm is active, a series of beeps sounds in the following pattern, which is repeated twice: 3 beeps, a pause, and then 2 more beeps. This indicator continues until the cause of the alarm is corrected or the audible alarm is silenced. The alarm descriptions later in this manual display this indicator as: • • • • • • • • • •
- **Medium Priority** - When a medium priority alarm is active, a series of beeps sounds in a 3-beep pattern. This pattern repeats until the cause of the alarm is corrected or the audible alarm is silenced. The alarm descriptions later in this manual display this indicator as: • • •
- **Low Priority** - When a low priority alarm is active, a series of beeps sounds in a 2-beep pattern. This pattern repeats until the cause of the alarm is corrected or the audible alarm is silenced. The alarm descriptions later in this manual display this indicator as: • •
- **Informational Messages and Confirmation Audible Indicators** - When an informational message appears on screen, a brief, 1-beep audible indicator sounds. Additionally, when the device detects that a certain action has been completed (for example, when an SD card is inserted or removed from the device) a brief, 1-beep audible indicator sounds. The descriptions later in this manual display this indicator as: •

Silencing an Alarm

You can silence an alarm by pressing the Alarm Silence/Indicator button. This will silence the alarm for one minute. If another alarm occurs while the silence period is active, the audible alarm portion of the new alarm will not sound until the silence period expires. When the silence period expires, the alarm's audible alarm is reactivated. Touching the Alarm Silence/Indicator button while the silence period is active will restart the silence period.

Alarm Message Screens

When an alarm message is activated, an alarm screen is displayed, showing the text or icon specific to the most recent, highest priority alarm.

Pressing the Control Wheel will reset the alarm and remove the alarm screen from the display. Resetting the alarm allows you to return to the previous screen. If multiple alarms occur during the same period of time, the alarm screen will display the higher priority alarm (higher priority alarms take precedence over lower priority alarms).

Alert Summary Table:

The following table summarizes all of the high, medium, and low priority alarms and informational messages.

ALARM	PRIORITY	AUDIBLE INDICATOR	VISUAL INDICATORS	DEVICE ACTION	USER ACTION
Loss of Power	High	• •	Red flashing button; Blank screen	Shuts down	Remove your mask. Press the Alarm Silence/Indicator button to silence the alarm. Check your power connections. Make sure there is power at the outlet or power source. Restore power to the device. If the alarm continues, contact your home care provider for service.
Device Inoperative	High		Red solid button; "Device Inoperative"	Shuts down	Remove your mask. Press the Alarm Silence/Indicator button to silence the alarm. Contact your home care provider for service.

ALARM	PRIORITY	AUDIBLE INDICATOR	VISUAL INDICATORS	DEVICE ACTION	USER ACTION
Low Pressure Alarm	High	• • • • •	Red flashing button; "Low Pressure"	Operates	This could be caused by an excessive leak or blockage or a device malfunction. Press the Alarm Silence/Indicator button to silence the alarm. Remove your mask. Check for the following: dirty inlet filters, blocked air intake, excessive leak in the patient circuit. If the alarm continues, contact your home care provider.
Low Speed	High	• • • • •	Red flashing button; "Low Blower Speed"	Operates	This may be caused by a malfunctioning device. Press the Alarm Silence/Indicator button to silence the alarm. Remove your mask. Remove power from the device. Restore power. If the alarm continues, contact your home care provider for service.
High Pressure	High	• • • • •	Red flashing button; "High Pressure"	Operates; If the alarm continues for 10 seconds, the alarm escalates to a Device Inoperative alarm	This may be caused by a malfunctioning device. Press the Alarm Silence/Indicator button to silence the alarm. Remove your mask. Remove power from the device. Restore power. If the alarm continues, contact your home care provider for service.
Low Pressure Support	High	• • • • •	Red flashing button; "Low Pressure Support"	Operates	This could be caused by an excessive leak or blockage or a device malfunction. Press the Alarm Silence/Indicator button to silence the alarm. Remove your mask. Check for the following: dirty inlet filters, blocked air intake, excessive leak in the patient circuit. If the alarm continues, contact your home care provider.
Apnea	High	• • • • •	Red flashing button; "Apnea"	Operates	This alarm is generated when an apnea event occurs during therapy. Press the Alarm Silence/Indicator button to silence the alarm. Report the alarm to your home care provider. Continue using your device.
Low Minute Ventilation	High	• • • • •	Red flashing button; "Low Minute Vent"	Operates	This alarm occurs when the calculated minute ventilation is less than or equal to the alarm setting. Press the Alarm Silence/Indicator button to silence the alarm. Report the alarm to your home care provider. Continue using your device.
Patient Disconnect	High	• • • • •	Red flashing button; "Patient Disconnect"	Operates	This alarm occurs when the patient circuit is disconnected or has a large leak. Press the Alarm Silence/Indicator button to silence the alarm. Reconnect the patient circuit or fix the leak. If the alarm continues, contact your home care provider for service.

ALARM	PRIORITY	AUDIBLE INDICATOR	VISUAL INDICATORS	DEVICE ACTION	USER ACTION
Low Input Voltage	Medium	• • •	Yellow flashing button; "Low Voltage"	Device Operates; Humidifier shuts down	The alarm is caused when input power at the device, either from an AC outlet or battery, falls below the acceptable limit for 10 seconds. Press the Alarm Silence/Indicator button to silence the alarm. If the device is plugged into a wall outlet, unplug the device and then plug it back in. If the alarm continues to occur, contact your home care provider for service. If you are using a battery, replace the battery or plug the device into an AC outlet. If the alarm continues, contact your home care provider for service.
SD Card Corrupted	Low	• •	Solid yellow button; "SD card corrupted Reformat card?"	Operates	This alarm occurs when a problem exists with the SD card. The data may be corrupted. Press the Alarm Silence/Indicator button to silence the alarm. Choose "yes" to reformat the card. If you choose "no" the card will not be reformatted. Note: Any information on the card will be lost when reformatted. Contact your home care provider with any questions.
SD Card Full	Low	• •	Solid yellow button; "SD card full"	Operates	This alarm occurs when the SD card is full. Press the Alarm Silence/Indicator button to silence the alarm. Remove the SD card and replace it.
SD Card: Remove and Reinsert	Low	• •	Solid yellow button; "Reinsert SD Card"	Operates	This alarm occurs when the device cannot read the SD card. The card may be inserted incorrectly. Remove the SD card and reinsert. If the alert continues to occur, replace the SD card or contact your home care provider.
SD Card: Prescription Rejected	Low	• •	Solid yellow button; "SD card inserted: prescription rejected"	Operates	This message occurs when the prescription is missing or incorrect. Contact your home care provider for the correct prescription.
SD Card: Prescription Accepted	Info	•	"SD card inserted: prescription accepted"	Operates	This info message will be present for 30 seconds or until the user acknowledges it. No action needed.
SD Card Removed	Info	•	"SD card removed"	Operates	This message occurs when the SD card is removed from the device. It is present for 30 seconds or until the user acknowledges it. No action is needed.

Troubleshooting

The table below lists some of the problems you may experience with your device and possible solutions to those problems.

PROBLEM	WHY IT HAPPENED	WHAT TO DO
Nothing happens when you apply power to the device. The backlights on the buttons do not light.	There is no power at the outlet or the device is unplugged.	If you are using AC power, check the outlet and verify that the device is properly plugged in. Make sure there is power available at the outlet. Make sure the AC power cord is connected correctly to the power supply and the power supply cord is securely connected to the device's power inlet. If the problem continues to occur, contact your home care provider. Return both the device and power supply to your provider, so they can determine if the problem is with the device or power supply. If you are using DC power, make sure your DC power cord and battery adaptor cable connections are secure. Check your battery. It may need recharged or replaced. If the problem persists, check the DC cord's fuse following the instructions supplied with your DC cord. The fuse may need to be replaced. If the problem still occurs, contact your home care provider.
The airflow does not turn on.	There may be a problem with the blower.	Make sure the device is powered correctly. Make sure "Therapy" or the  icon is highlighted when pressing the control wheel to start airflow. If the airflow does not turn on, there may be a problem with your device. Contact your home care provider for assistance.
The device's display is erratic.	The device has been dropped or mishandled, or the device is in an area with high Electromagnetic Interference (EMI) emissions.	Unplug the device. Reapply power to the device. If the problem continues, relocate the device to an area with lower EMI emissions (away from electronic equipment such as cellular phones, cordless phones, computers, TVs, electronic games, hair dryers, etc.). If the problem still occurs, contact your home care provider for assistance.
The Ramp feature does not work when you press the Ramp button.	Your home care provider did not prescribe Ramp for you, or your prescription pressure is already set to the minimum setting.	If Ramp has not been prescribed for you, discuss this feature with your home care provider to see if they will change your prescription. If your provider has enabled Ramp, but the feature still does not work, check the pressure setting on the Monitor Pressure screen. If it is set to the minimum setting (4.0 cm H ₂ O), or the starting pressure is the same as the prescribed pressure, the Ramp feature will not work.
The airflow is much warmer than usual.	The air filters may be dirty. The device may be operating in direct sunlight or near a heater.	Clean or replace the air filters. The temperature of the air may vary somewhat based on your room temperature. Make sure that the device is properly ventilated. Keep the device away from bedding or curtains that could block the flow of air around the device. Make sure the device is away from direct sunlight and heating equipment. If using the humidifier with the device, check the humidifier settings. Refer to the humidifier instructions to make sure the humidifier is working properly. If the problem continues, contact your home care provider.
The airflow pressure feels too high or too low.	The Tubing type setting may be incorrect.	Make sure the Tubing type setting (22 or 15) matches the tubing that you are using (Respironics 22 mm tubing, or the optional Respironics 15 mm tubing). If the problem continues, contact your home care provider.
The mask feels uncomfortable to wear, there is significant air leakage around the mask, or you experience other mask-related issues.	This could be due to improper headgear adjustment or improper mask fitting.	Make sure you are properly fitted with the correct size mask. If the problem continues, contact your home care provider to be fitted with a different mask.
You have a runny nose.	This may be caused by a nasal reaction to the airflow.	Contact your home care provider.

Accessories

There are several accessories available for your BiPAP autoSV Advanced System One device such as a humidifier, Oximetry module or a modem. Contact your home care provider for additional information on the available accessories. When using optional accessories, always follow the instructions enclosed with the accessories.

CAUTION: Pins of connectors should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. Precautionary procedures include methods to prevent build-up of electrostatic charge (e.g., air conditioning, humidification, conductive floor coverings, non-synthetic clothing), discharging one's body to the frame of the equipment or system or to earth or a large metal object, and bonding oneself by means of a wrist strap to the equipment or system or to earth.

• Adding a Humidifier

You can use the System One Heated humidifier or the Passover humidifier with your device. They are available from your home care provider. A humidifier may reduce nasal dryness and irritation by adding moisture to the airflow.

Note: Refer to the humidifier's instructions for complete setup information.

• Using the SD Card

The BiPAP autoSV Advanced System One comes with an SD card inserted in the SD card slot on the back of the device to record information for the home care provider. Your home care provider may ask you to periodically remove the SD card and send it to them for evaluation.

Note: If the SD card is inserted in the device, the SD card icon () will display next to "Info" on the Home screen and it will also display in the lower left corner of the Therapy screen.

Note: The SD card does not need to be installed for the device to work properly. The SD card records device usage information for your home care provider. You can refer to the Device Alerts section in this manual for more information on the SD card. Contact your provider if you have any questions about the SD card.

• Adding Supplemental Oxygen

Oxygen may be added at the mask connection. Please note the warnings listed below when using oxygen with the device.

WARNINGS:

- When using oxygen with this system, a Respirationics Pressure Valve must be placed in-line with the patient circuit between the device and the oxygen source. The pressure valve helps prevent the backflow of oxygen from the patient circuit into the device when the unit is off. Failure to use the pressure valve could result in a fire hazard.
Note: Refer to the pressure valve's instructions for complete setup information.
- When using oxygen with this system, turn the device on before turning on the oxygen. Turn the oxygen off before turning the device off. This will prevent oxygen accumulation in the device.
- Oxygen supports combustion. Oxygen should not be used while smoking or in the presence of an open flame.
- When using oxygen with this system, the oxygen supply must comply with local regulations for medical oxygen.
- Do not connect the device to an unregulated or high pressure oxygen source.

• Supplying DC Power to the Device

The Respirationics DC Power Cord can be used to operate this device in a stationary recreational vehicle, boat, or motor home. The Respirationics DC Battery Adapter Cable, when used with the DC Power Cord, enables the device to be operated from a 12 VDC free-standing battery.

CAUTION: When DC power is obtained from a vehicle battery, the device should not be used while the vehicle's engine is running. Damage to the device may occur.

CAUTION: Only use a Respirationics DC Power Cord and Battery Adapter Cable. Use of any other system may cause damage to the device.

Refer to the instructions supplied with the DC Power Cord and adapter cable for information on how to operate the device using DC power.

Traveling with the System

When traveling, the carrying case is for carry-on luggage only. The carrying case will not protect the system if it is put through checked baggage.

For your convenience at security stations, there is a note on the bottom of the device stating that it is medical equipment and is suitable for airline use. It may be helpful to bring this manual along with you to help security personnel understand the BiPAP autoSV Advanced System One device.

If you are traveling to a country with a line voltage different than the one you are currently using, a different power cord or an international plug adaptor may be required to make your power cord compatible with the power outlets of the country to which you are traveling. Contact your home care provider for additional information.

• Airline Travel

The device is suitable for use on airlines when the device is operating from an AC or DC power source.

Home Cleaning

• Cleaning the Device

WARNING: To avoid electrical shock, always unplug the power cord from the wall outlet before cleaning the device. DO NOT immerse the device in any fluids.

1. Unplug the device, and wipe the outside of the device with a cloth slightly dampened with water and a mild detergent. Let the device dry completely before plugging in the power cord.
2. Inspect the device and all circuit parts for damage after cleaning. Replace any damaged parts.

• Cleaning or Replacing the Filters

Under normal usage, you should clean the gray foam filter at least once every two weeks and replace it with a new one every six months. The white ultra-fine filter is disposable and should be replaced after 30 nights of use or sooner if it appears dirty. DO NOT clean the ultra-fine filter.

CAUTION: Dirty inlet filters may cause high operating temperatures that may affect device performance. Regularly examine the inlet filters as needed for integrity and cleanliness.

1. If the device is operating, stop the airflow. Disconnect the device from the power source.
2. Remove the filter(s) from the enclosure by gently squeezing the filter in the center and pulling it away from the device.
3. Examine the filter(s) for cleanliness and integrity.
4. Wash the gray foam filter in warm water with a mild detergent. Rinse thoroughly to remove all detergent residue. Allow the filter to air dry completely before reinstalling it. If the foam filter is torn, replace it. (Only Respironics-supplied filters should be used as replacement filters.)
5. If the white ultra-fine filter is dirty or torn, replace it.
6. Reinstall the filters, inserting the white ultra-fine filter first if applicable.

CAUTION: Never install a wet filter into the device. You must ensure sufficient drying time for the cleaned filter.

• Cleaning the Tubing

Clean the tubing before first use and daily. Disconnect the flexible tubing from the device. Gently wash the tubing in a solution of warm water and a mild detergent. Rinse thoroughly. Air dry.

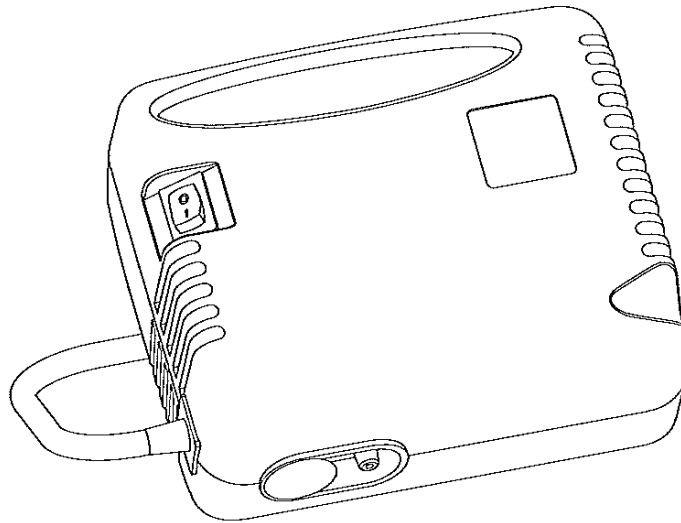
Service

The device does not require routine servicing.

WARNING: If you notice any unexplained changes in the performance of this device, if it is making unusual or harsh sounds, if it has been dropped or mishandled, if water is spilled into the enclosure, or if the enclosure is broken, disconnect the power cord and discontinue use. Contact your home care provider.

Medication Nebulizers:

Compressor Nebulizer System





Medication Nebulizers Instruction Check Sheet

Demonstrate:

- _____ Assembling medication nebulizer
- _____ Administration of treatment to resident
- _____ Assessment of resident during treatment
- _____ Changing filter in small air compressor

Explain:

- _____ Indications of aerosolized medications
- _____ How bronchodilators work
- _____ Hazards of administering medications
- _____ Trouble shooting compressor
- _____ Infection control for equipment

Nurse: _____

Instructor: _____

Date: _____

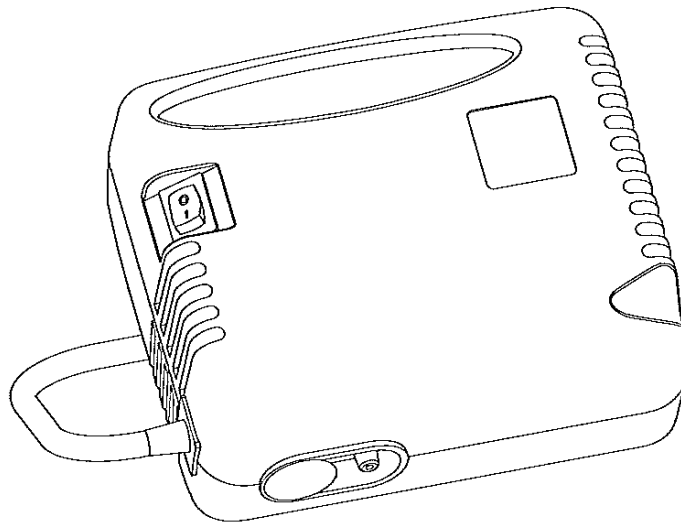
Medication Nebulizers

Overview

1. Aerosolized medications are delivered to the airways to decrease bronchoconstriction in the airways and improve air exchange.
2. Residents with diagnosis benefiting from bronchodilators include:
 - a. Pneumonia
 - b. Emphysema
 - c. Asthma
 - d. Chronic Bronchitis
 - e. Bronchiectasis
3. Medication, dosage and frequency should be included in the MD order.
4. Assess resident before, during and after treatment (heart rate, respiratory rate, sounds,, and work of breathing).
5. Instruct the resident to breathe deeply during the treatment and cough strongly for the treatment.
6. Hazards include tachycardia, palpitations, increased tremor, and hyperventilation.
7. Document medication, assessment, and sputum production.
8. Place small air compressor on sturdy surface while using.
9. Check filter weekly and replace when necessary.
10. Rinse medication nebulizer after each use and change weekly.

Medication Nebulizers
Operators Manual

Invacare Compressor Nebulizer System



*The following is an excerpt from Invacare's Compressor
Nebulizer System Operators Manual*

SECTION 2—OPERATING INSTRUCTIONS

SECTION 2—OPERATING INSTRUCTIONS

WARNING

DO NOT operate unit without filter.
Avoid operating this product in a dusty environment.
Otherwise, premature compressor wear could occur.

NOTE: Clean and disinfect the nebulizer and mouthpiece before using the device for the first time. Refer to Cleaning and Disinfecting on page 20.

Setup

NOTE: For this procedure, refer to FIGURE 2.1 on page 17.

1. Place the unit on a table or other flat, stable surface. Be sure you can easily reach the controls when you are seated.
-

CAUTION

Make sure the power switch is in the off “O” position.

2. Gently twist the nebulizer to separate it into two sections.
-

SECTION 2—OPERATING INSTRUCTIONS

3. Be sure the pick-up funnel is in place in the bottom section of the nebulizer.

CAUTION

DO NOT add over 6 ml of medication to the medication cup. The maximum capacity of the nebulizer medication cup is 6 ml.

4. Add the prescribed amount of medication to the cup of the nebulizer using an eyedropper, pre-measured dose or ampoule.

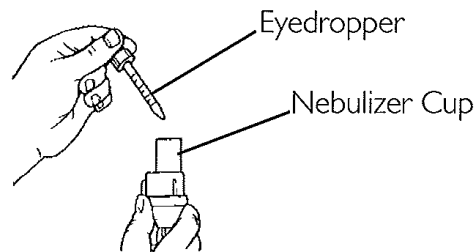


FIGURE 2.1 Adding Medication

5. Gently twist the top and bottom sections together to assemble the nebulizer. Be sure the two sections fit securely.
6. Attach one end of the air tubing to the air tubing connector located on the front of the compressor.

SECTION 2—OPERATING INSTRUCTIONS

7. Attach the other end of the air tubing to the base of the nebulizer.

NOTE: Ensure nebulizer tubing is firmly attached to compressor before use.

⚠ WARNING

In the case of high humidity, condensation may form inside the internal tubing. Run the unit for two minutes before connecting the nebulizer to the tubing.

-
8. Attach the mouthpiece to the top section of the nebulizer. Refer to the nebulizer manual for additional instructions.

NOTE: Before starting a cold unit, let the unit reach room temperature in a heated area.

9. With the power switch off, plug the power cord into an appropriate electrical outlet.

CAUTION

This device is for intermittent use: 30 min. ON / 30 min. OFF. Failure to operate within these limits could damage the device beyond repair.

SECTION 2—OPERATING INSTRUCTIONS

Treatment Instructions

NOTE: For this procedure, refer to FIGURE 2.2.

1. Turn the unit on, pressing the ON/OFF switch to the “I” position.
2. Place mouthpiece between your teeth, close your mouth and tilt the nebulizer toward your mouth.



FIGURE 2.2 Using the Nebulizer

3. As aerosol begins to flow, inhale deeply, slowly, and hold breath for ten seconds. Then exhale slowly through the mouthpiece.

NOTE: If you need to rest during a treatment, be sure the nebulizer remains in an upright position; otherwise, the medication may spill.

4. When treatment is complete, turn the unit off by setting the switch to the “O” position and unplug the unit from the electrical outlet.
5. Before storing supplies between treatments, clean and dry the nebulizer and accessories. Refer to Cleaning and Disinfecting on page 20.

SECTION 3—CLEANING AND DISINFECTING

SECTION 3—CLEANING AND DISINFECTING

Following the cleaning instructions after each use will prevent any remaining medication in the nebulizer cup from drying and causing the device to nebulize ineffectively.

It is recommended that the nebulizer and the mouthpiece be thoroughly rinsed with hot tap water after each use and cleaned with a mild detergent after the last treatment of the day. The same pieces **MUST** also be disinfected daily by soaking in a vinegar/water solution or a commercially available disinfectant. If your physician or respiratory therapist specifies a different cleaning procedure, follow their instructions.

Cleaning the Outer Case

⚠ WARNING

Unplug unit before cleaning.

DO NOT submerge in water to clean. Clean outer case with damp cloth.

SECTION 3—CLEANING AND DISINFECTING

DANGER

DO NOT attempt to separate the outer case of this unit. Removing the case creates a serious electrical shock hazard. All disassembly and maintenance of this unit **MUST** be done by a qualified technician.

Cleaning the Nebulizer

WARNING

To prevent possible risk of infection due to contamination, follow these instructions:

- Clean the nebulizer before initial operations.
 - Clean the nebulizer after each aerosol treatment.
 - ALWAYS use fresh cleaning solution.
 - DO NOT towel dry the nebulizer components after cleaning.
-

NOTE: Your physician and/or an Invacare dealer may specify certain cleaning procedures. If so, follow their recommendations. If not, clean according to the following instructions:

1. Remove the nebulizer and mouthpiece from the tubing.
-

SECTION 3—CLEANING AND DISINFECTING

2. Disassemble nebulizer chamber by turning counterclockwise and separating.
3. Fill two plastic containers or bowls:
 - A. Washing: Hot water/detergent solution.
 - B. Soaking: Hot water/vinegar solution (one part vinegar to three parts water).
4. Thoroughly clean the nebulizer and mouthpiece in hot water/detergent solution.
5. Remove from the water/detergent solution and rinse with clear hot tap water.
6. Soak in hot water/vinegar solution for 30 minutes.
7. Rinse with hot tap water again and air dry thoroughly.

NOTE: If using medical disinfectant cleaners, follow manufacturer's instructions carefully.

8. Keep the outer surface of the tubing dust-free by wiping regularly.

NOTE: The nebulizer air tubing does not have to be washed internally because only filtered air passes through the tubing.

SECTION 3—CLEANING AND DISINFECTING

Cleaning the Compressor

CAUTION

Unplug unit before cleaning. DO NOT submerge in water to clean.

DO NOT clean using abrasive cleaners.

1. Clean the casing of the main unit daily by using a soft cloth moistened with water or a mild detergent.
2. Wipe the casing and immediately dry using a soft clean cloth.

Cleaning the Mouthpiece

1. Boil the mouthpiece in water for a maximum of five minutes or autoclave at a maximum of 121° C for ten minutes.
2. Allow the mouthpiece to air dry.
3. Once dry, the mouthpiece may be stored inside the nebulizer top.

SECTION 4—MAINTENANCE

DANGER

DO NOT attempt to separate the outer case of this unit. Removing the case creates a serious electrical shock hazard. All disassembly and maintenance of this unit **MUST** be done by a qualified technician.

Routine Care

To keep your device in the best condition and protect the unit from damage, follow these directions:

- DO NOT subject the device or the parts to any strong shocks such as dropping the device on the floor.
- DO NOT store the device in extreme hot or cold temperatures, high humidity or under direct sunlight.

Storage

Store the repackaged device in a dry and safe area. DO NOT place other objects on top of the repackaged device.

SECTION 4—MAINTENANCE

Nebulizer Change

The nebulizer is designed for single patient use. The nebulizer **MUST** be replaced after a long period of inactivity, or when it is obstructed by dry medication, dust, etc. Reusable nebulizers should last from six months to one year with general use. Refer to the nebulizers owner's manual. Disposable nebulizers should last 30 days. For disposable nebulizers, it is recommended that an extra nebulizer be kept at all times. Refer to the disposable nebulizer's owner's manual.

Filter Change

1. The filter **MUST** be replaced after approximately 30 hours of use or when it turns grey.
2. Open the filter holder to replace the filter with a new one.

CAUTION

DO NOT use cotton or any other material.

DO NOT wash or clean the filter.

Use only Invacare filters.

DO NOT operate unit without an air filter.

SECTION 5—TROUBLESHOOTING

SECTION 5—TROUBLESHOOTING

PROBLEM	SOLUTION
Device does not switch ON.	1. Make sure the plug is firmly fitted to the wall socket. 2. Try plugging into another wall socket that is known to work. 3. Contact your Invacare dealer.
Device does not nebulize, or it nebulizes weakly.	1. Make sure that the ends of the air tubing are fitted tightly onto the main unit and onto the nebulizer. 2. Check whether the nebulizer is empty of medication or has too much medication (MAX 6ml). 3. Check whether the nebulizer nozzle is obstructed. 4. Check whether the funnel is inserted. If these possible solutions DO NOT work, contact your Invacare dealer.

Oxygen Therapy:

Overview • Application • Devices





Oxygen Therapy Instruction Check Sheet

Demonstrate:

_____ FIO₂ concentration delivery methods:

- Nasal Cannula
- Venturi Mask
- Simple Mask
- Non-Rebreather mask

_____ Adequate liter flow for:

- Nasal Cannula
- Venturi Mask
- Simple Mask
- Non-Rebreather mask

Explain:

_____ The danger of high concentrations of oxygen with residents with known history of COPD

_____ Which devices can only be used with oxygen tanks

_____ Emergency Application of Oxygen

Nurse: _____

Instructor: _____

Date: _____

Oxygen Therapy Overview

Purpose:

To treat hypoxemia, decrease work of breathing and decrease myocardial work

Scope:

Patient's requiring supplemental O₂ therapy due to respiratory or cardiac insufficiency

Procedure:

- Follow Universal Precautions
- Verify Medical Doctor order (should include liter flow, type of O₂ delivery device if possible)
- Wash hands and explain procedure to the patient
- Confirm the patient's identification from the wristband
- Gather equipment:
 - O₂ source
 - Oxygen delivery device
 - Humidifier with sterile water if indicated
- Connect the humidifier bottle filled with sterile water to the O₂ source, making sure all connections are tight
- Turn on the O₂ source and adjust the flowmeter to the prescribed flow
- Verify the flow of O₂ at the patient end of the delivery device
- Connect the O₂ delivery device to the patient
- Simple masks should be run at 5-10 lpm
- Non-Rebreather masks should be run at an adequate flow so that the bag doesn't deflate on the maximal inspiration(at least 6lpm)
- Venturi mask flow should be advised as per Venturi device indicating desired FIO₂



Oxygen Therapy

Emergency Application of Oxygen

General Patients

1. Any patient having trouble breathing should be sitting straight up to obtain maximal diaphragm movement and maximal tidal volume.
 - a. Obtain a O2 Saturation to establish the potential O2 deficit.
2. Place patient on O2 up to 4lpm. If patient's O2 saturation does not improve or if the patient is still having trouble breathing place the patient on a simple mask at 6-8 lpm.
3. If the patient is in severe distress, place the patient on a non-Rebreather
4. Mask at 10-12 lpm.

COPD Patients

1. Place the patient on a nasal cannula at 2 lpm unless otherwise instructed by the physician.
2. Make sure the patient is in a proper sitting position and encourage the patient to take slow deep breaths and practice pursed lip breathing.
3. Try to keep the patient's room cool-too much heat can cause shortness of breath in a COPD patient.

NOTE: THESE ARE VERY GENERAL GUIDELINES. EVERY PATIENT NEEDS TO BE ASSESSED INDIVIDUALLY TO DETERMINE THERE OWN OXYGEN REQUIREMENT.

Oxygen Therapy Delivery Devices

Nasal Cannulas

- Most commonly used device
- Nasal passages must be patent
- Mouth breathing does not affect the O₂ delivery too much, because the O₂ flows into the oropharynx
- Humidifier bottles may be used-be sure that all connections are tight to avoid leakage
- Estimated FiO₂:
 - 1L=24%
 - 2L=28%
 - 3L=32%
 - 4L=35%
 - 5-6L=40%

Venti Masks

- Designed to deliver an exact prescribed dose of oxygen (COPD) patients with CO₂ retention)
- By changing the valve or orifice size, the FiO₂ can be varied. This is achieved by entraining room air through ports at the base of the mask.
- Venti masks can deliver FiO₂s like 24%, 28%,31%,35%,40% and 50%.
- Particularly effective in treating patients when there is a danger of respiratory depression from excessive O₂ concentrations.
- Some disadvantages:
 - Feeling of claustrophobia
 - Removal of masks by patients so they can eat or cough
 - Requires a high flow of oxygen and not practical for home use

Note: DO NOT RUN VENTIMASKS OFF OF OXYGEN CONCENTRATORS-THEY MUST BE RUN OFF OF OXYGEN TANKS.

Simple O₂ Masks

- Delivers approximately 50% O₂
- Flow must be at least 5-8 LPM so that the patient does not accumulate CO

NOTE: DO NOT RUN ANY MASKS OF THE OXYGEN CONCENTRATOR-THEY DO NOT PROVIDE ENOUGH PRESSURE! RUN ALL MASKS OFF OF THE OXYGEN TANK.

Non-Rebreather masks

- Has a reservoir bag attached and delivers around 90% O₂
- Requires a high flow to keep the reservoir bag fully inflated when the patient takes a deep breath (10-12 LPM)

NOTE: DO NOT RUN THE MASK OFF OF THE OXYGEN CONCENTRATOR - THEY DO NOT PROVIDE ENOUGH PRESSURE! RUN ALL MASKS OFF OF THE OXYGEN TANK.

Therapy Services:

Pulse Oximetry





Pulse Oximetry

Instruction Check Sheet

Demonstrate:

- _____ How to turn oximeter on and off
- _____ How to turn oximeter on and off
- _____ Placement of Finger Probe
- _____ Proper cleaning technique of finger probe
- _____ How to read results

Explain:

- _____ Things that affect readings
- _____ Normal ranges for Pulse Oximetry
- _____ Infection Control

Nurse: _____

Instructor: _____

Date: _____

Pulse Oximetry Overview

Pulse oximetry works by photospectrometry. A light on the inside of the patient probe shines a light through the tissue and receives a signal on the other side. If the patient's blood is well saturated with oxygen, a certain kind of wavelength of light is transmitted. If the hemoglobin is not well saturated with oxygen, another type of wavelength is transmitted. The only way to get a direct measurement of arterial oxygenation is an arterial blood gas. The pulse oximeter provides a painless, noninvasive, cost effective manner of estimating the patient's oxyhemoglobin.

When using the pulse oximeter:

- Clean the inside of the probe and the patient's finger with alcohol. This removes any residue on the light source and finger that may interfere with the reading.
- Place the lighted side of the probe on the nail bed
- **DO NOT** squeeze the probe on the patient's finger as tissue injury or a poor reading will occur.
- Watch the strength of the wavelength on the pulse oximeter (if available) to verify the stability of the reading.
- Watch the patient's SpO₂ reading for several minutes until it is stabilized. If an inadequate or questionable reading is obtained, select another finger.
- If you cannot believe the heart rate displayed, you cannot trust the SpO₂ reading.
- Manually palpate the patient's pulse to verify the pulse rate displayed on the oximeter.

Things that may affect readings:

- Motion artifact
- Abnormal hemoglobin
- Low perfusion states
- Nail polish
- Exposure of probe to ambient light

NOTE: The pulse oximeter is only a tool to assist you in the total clinical evaluation of a patient

Pulse Oximetry Operators Manual

Nonin GO₂



*The following is an excerpt from Global Primary Care and
Patient Education Handbook*

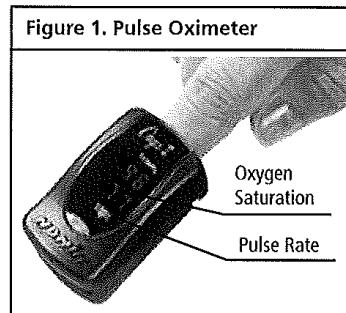
THE PURPOSE OF THIS GUIDE

Chronic respiratory diseases such as COPD and asthma are among the most common health conditions seen in primary care practices, affecting more than 1 billion patients worldwide. Primary care clinicians are also often the first point of contact for patients suffering from acute respiratory infections such as influenza and pneumonia. These health care professionals need tools to help them evaluate, monitor, and decide when to refer patients with respiratory conditions.

Pulse oximetry is a technology that enables the noninvasive measurement of oxygen saturation, contributing to this measure's rapid acceptance as a "fifth vital sign" (in addition to temperature, blood pressure, pulse, and respiratory rate) in clinical assessment. Although the technology has been available since the 1970s, recent advances have reduced the size and cost of pulse oximeters, and as a result these devices (Figure 1) are becoming increasingly used in respiratory patient monitoring in specialty and primary care practice.

In most countries, oximeters are only sold to patients under the guidance of a licensed health care professional, and use by patients should be supervised by their physicians or other qualified health care provider. Incorrect or inappropriate use of oximeters will not provide useful information, and they should be used as part of a broader clinical assessment and not in isolation.

Primary care clinicians have varying levels of awareness of pulse oximetry and knowledge of its proper uses. Therefore, this World Organization of Family Doctors (Wonca) and International COPD Coalition (ICC) guide offers advice for those who wish to use pulse oximeters in patient care. It presents the clinical situations in which the devices are being used and the scientific evidence for such uses, and it points out the limitations of the devices and inappropriate uses.



In addition to scientific articles, we are guided in our recommendations by the expert opinions of the faculty who have overseen the development of this pocket guide. It will be important for clinicians and their patients to monitor the appearance of new published, peer-reviewed clinical research concerning the clinical and home uses of pulse oximetry.

This document was prepared by the Wonca expert panel including Antonio Anzueto, Richard Casaburi, Stephen Holmes, and Tjard Schermer, with Youssef Mohammad, Chair. It was developed in collaboration with the International Primary Care Respiratory Group (IPCRG) and the European Federation of Allergy and Airways Diseases Patients Associations (EFA). The panel members have also solicited input from various experts working in developing countries in order to produce a document that will be relevant to a variety of health care systems and socioeconomic conditions.

BACKGROUND AND PRINCIPLES OF PULSE OXIMETRY

Pulse oximetry is a noninvasive method that enables rapid measurement of the oxygen saturation of hemoglobin in arterial blood. [1] It can rapidly detect changes in oxygen saturation, thus providing an early warning of dangerous hypoxemia. [2, 3]

The use of pulse oximetry for patient assessment and monitoring is well established in critical care, anesthesiology, and emergency departments. [2] In recent years, the availability of small, user-friendly, portable and affordable pulse oximeters, including those worn on the finger-tip has opened up the potential for use of this technique in an expanded variety of clinical settings, including primary care. [4]

A pulse oximeter shines light at two wavelengths—red and infrared—through a part of the body that is relatively translucent and has good arterial pulsed blood flow (e.g., finger, toe, earlobe) (Figure 2a). The ratio of red to infrared light that passes through the measurement site and is received by the oximeter's detector depends on the percentage of oxygenated versus deoxygenated hemoglobin through which the light passes (Figure 2b). [2] The percentage of oxygen saturation thus calculated is referred to as the percent SpO_2 . [3]

Figure 2. Pulse Oximeter Function

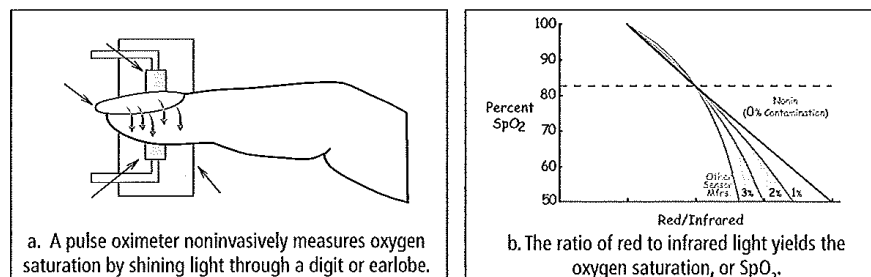


Table 1. Evaluation of SpO_2 measurements

- o An SpO_2 of greater than 95% is generally considered to be normal.
- o An SpO_2 of 92% or less (at sea level) suggests hypoxemia.
 - In a patient with acute respiratory illness (e.g., influenza) or breathing difficulty (e.g., an asthma attack), an SpO_2 of 92% or less may indicate a need for oxygen supplementation.
 - In a patient with stable chronic disease (e.g., COPD), an SpO_2 of 92% or less should prompt referral for further investigation of the need for long-term oxygen therapy [5, 6].

Pulse oximetry can be a useful aid to clinical decision-making, but is not a substitute for a clinical assessment nor sufficient for diagnosis by itself. [4] Arterial blood gas measurements, obtained by arterial puncture, remain the gold standard for measurement of oxygen saturation. [2] Pulse oximetry is valuable in triaging potentially hypoxic patients in the home, office, and clinic or hospital settings to determine which patients should have arterial blood gas measurements.

CURRENT CLINICAL USES OF PULSE OXIMETRY

A small but growing body of research, detailed in Table 2, is establishing the usefulness of pulse oximetry in primary care, particularly—but not exclusively—for the management of acute and chronic respiratory disease.

In patients with COPD, pulse oximetry is useful in stable patients with severe disease ($FEV_1 < 50\%$ predicted), and in patients with worsening symptoms or other signs of an acute exacerbation, as a tool for patients to use at home to assist with their management under physician guidance. It is important to note that pulse oximetry complements, rather than competes with, spirometry in the assessment of COPD patients. Spirometry remains the gold standard for diagnosing and staging COPD, while pulse oximetry provides a method for rapid assessment especially of short-term respiratory compromise.

In patients with asthma, pulse oximetry complements peak flow meters in assessing the severity of asthma attacks/exacerbations and response to a treatment.

In patients with acute respiratory infection, pulse oximetry is useful in evaluating the severity of the illness and, in conjunction with other criteria, determining whether and how to refer patients for further treatment.

Table 2 gives further details about the recommended indications for use of pulse oximetry in various primary care situations. Recommendations about the use of pulse oximetry in specific primary care situations have also been incorporated into some guideline documents for respiratory care. [For a summary of recommendations from several such documents, see Ref. 7; also see 6, 8, 9, 10, 11.] Although pulse oximeters may also have additional applications in certain health care settings, the most common and best-evidenced primary care uses of pulse oximeters are covered here.

LIMITATIONS OF PULSE OXIMETRY

Despite recent technological improvements, pulse oximeters have some limitations that can affect the accuracy of the measurement. Clinicians should be aware of certain situations where the oximeter reading may not be accurate (Table 3).

In addition, some patients with severe chronic lung disease experience hypoxic drive, in which respiration is driven by low oxygen levels rather than elevated carbon dioxide levels. These patients often have severe disease and may already be on long-term oxygen therapy. This condition does not affect the accuracy of pulse oximetry readings, but it does affect the goals of monitoring and treatment. Specifically, to avoid hypercapnia, for some of these patients the goal should be to maintain SpO_2 at a somewhat lower target (e.g., between 88-92%). [3]

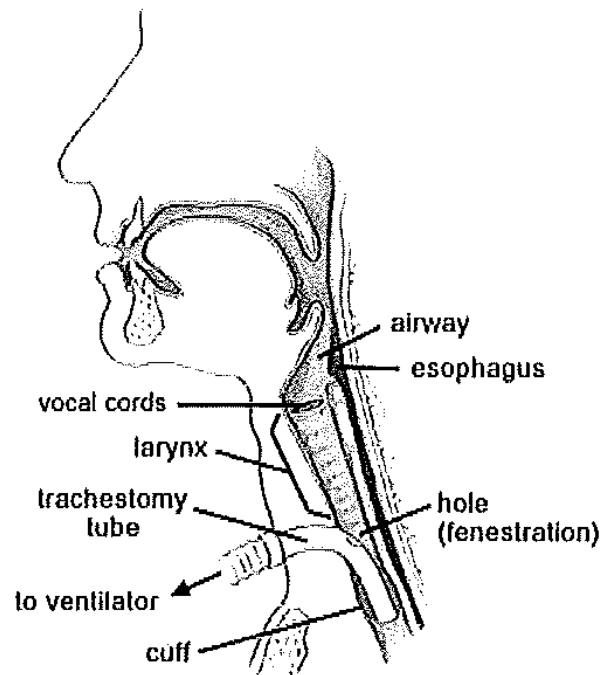
Table 2. Current Clinical Uses of Pulse Oximetry in Primary Care
COPD
<i>Stable disease</i> - Establishing a baseline value in patients with stable disease. [4] - Monitoring of patients with exercise-related dyspnea. [4] - In patients with moderate to severe COPD, a screening tool to identify patients (i.e., those with $\text{SpO}_2 < 92\%$) who should be referred for comprehensive oxygen assessment. [3] - In patients with stable COPD or those recovering from an exacerbation at home, an SpO_2 88% or less is a strong indication to initiate long-term oxygen therapy. [12] However, ideally the decision to initiate oxygen therapy should be made based on arterial oxygen tension ($\text{PaO}_2 < 7.3 \text{ kPa} / 55 \text{ mm Hg}$). - Titration of oxygen flow setting in patients on long-term oxygen therapy, provided their disease is stable and they have good circulation. In general, the goal should be to maintain $\text{SpO}_2 > 90\%$ during all activities. [7] - Evaluation of patients with severe disease ($\text{FEV}_1 < 50\%$ predicted), cyanosis, or cor pulmonale for possible respiratory insufficiency/failure. [4, 7] <i>Exacerbations</i> - Assessment of patients with acutely worsening symptoms, especially dyspnea, and determination of the severity of the exacerbation. [4, 7] - Triage for arterial blood gas measurement, referral to emergency department, and/or determination of whether to initiate oxygen therapy or other treatment for exacerbation. [4] - Monitoring patients after the initiation of oxygen therapy. Measure SpO_2 regularly—every 5 to 30 minutes [13], especially if the patient's clinical condition deteriorates. For patients at risk of hypercapnic respiratory failure, aim to maintain SpO_2 88-92%; for all other patients, aim for SpO_2 94-98%. [14]. - Evaluating patients for initiation of hospital-at-home/intermediate care, and monitoring them once they are enrolled in this form of care. [7]
Asthma
<i>During an asthma attack:</i> - Evaluation and assessment of severity, complementing peak flow meter data. [3, 4] - Triage for arterial blood gas measurement, referral to emergency department, and/or determining when to initiate acute oxygen therapy. [7] - Monitoring patients after the initiation of oxygen therapy or response to other therapy (see COPD Exacerbations above). - Particularly important in children with severe acute wheezing. [7] - Follow-up of patients after a severe or complicated exacerbation. [4]
Acute respiratory infection (e.g., community-acquired pneumonia, influenza, AIDS-related lung infections)
- Assessing the severity of a lower respiratory tract infection. [4] - Triage for arterial blood gas measurement, referral to emergency department/specialist, and/or determining when to initiate acute oxygen therapy. [4, 7] - Monitoring patients after the initiation of oxygen therapy (see COPD Exacerbations above).
Breathlessness in children
- Part of clinical assessment for children with suspected significant respiratory tract infection. - Part of clinical assessment in children with acute asthma. [15, 16, 17, 18]

Table 3. Limitations of Pulse Oximetry*	
Conditions	Problem
SpO ₂ values < 80%	Pulse oximeters can overestimate oxygen saturation, particularly in those with darkly pigmented skin. [19]
Poor perfusion (cold digits) due to hypotension, hypovolemic shock, cold environment, or cardiac failure	May result in the machine not providing a reading. [3]
Anemia	Oxygen delivery to tissues is inadequate but SpO ₂ is normal.
Carbon monoxide poisoning	Carbon monoxide binds to hemoglobin, resulting in inadequate oxygen transport despite normal pulse oximeter readings. [3]
Certain antiretroviral medications	Affect oxygen's affinity for hemoglobin. [20]
Movement, shivering patient, heart arrhythmias	Oximeter may not be able to identify an adequate pulse signal. [3]
Nail polish, dirt, artificial nails	Can cause false low readings or no readings. [3]
Bright artificial light (as in an operating room)	Can cause false low readings. [3]
Older patients	Normal oxygen saturation levels may be slightly lower than in younger people. [3]
Sickle cell disease	Does not confound SpO ₂ results in adults [21], but may in children. [22]

* Consult manufacturers' recommendations regarding the effects of low perfusion and performance in darkly pigmented skin.

Tracheostomy Care:

Respiratory Care & Tracheostomy Tubes





Tracheostomy Care Instruction Check Sheet

Demonstrate:

- _____ Proper equipment needed
- _____ Removing old inner cannula and inserting new inner cannula
- _____ Inspection and cleaning of stoma site
- _____ Adjusting trach collar properly

Explain:

- _____ Different types and sizes of trach tubes
- _____ Hazards of performing trach care
- _____ Abnormal conditions of trach to report to Physician

Nurse: _____

Instructor: _____

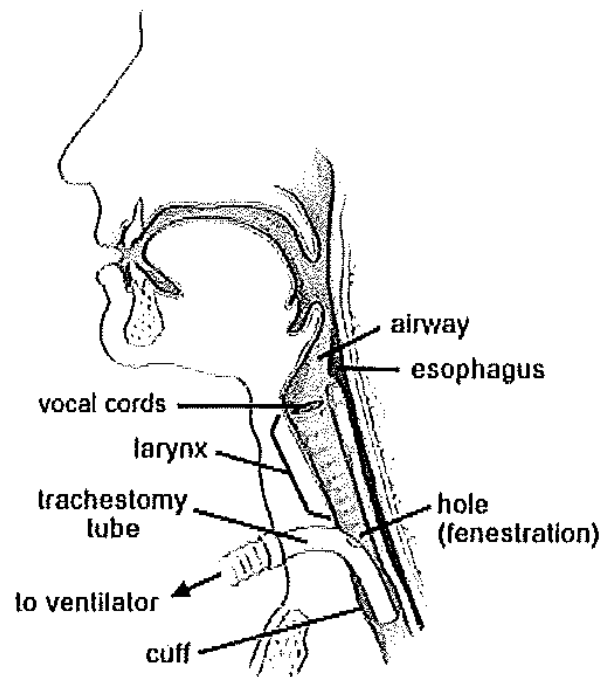
Date: _____

Tracheostomy Care Overview

1. Each resident has a specific trach tube, as ordered by a Physician.
2. Every trach resident should have a spare back up trach at the bedside for emergency reinsertion.
3. Tracheostomy tubes have different sizes and styles:
 - a. Adult and pediatric
 - b. Cuffed and uncuffed
 - c. Fenestrated and non-fenestrated
 - d. Disposable inner cannulas and non-disposable inner cannulas.
 - e. Different sizes
 - f. Different brands
4. Trach tubes and stoma sites require regular cleaning.
5. Trach tubes should be changed monthly.
6. Hazards of tracheostomies:
 - a. If there is redness, bleeding, or drainage from stoma, it should be reported to the resident's nurse.
 - b. Whenever the tube is manipulated, respiratory, cardiovascular and skin parameters should be assessed.
7. Humidification is necessary for artificial airways.
8. Suctioning is necessary to insure patent airway.

Tracheostomy Care Educational Booklet

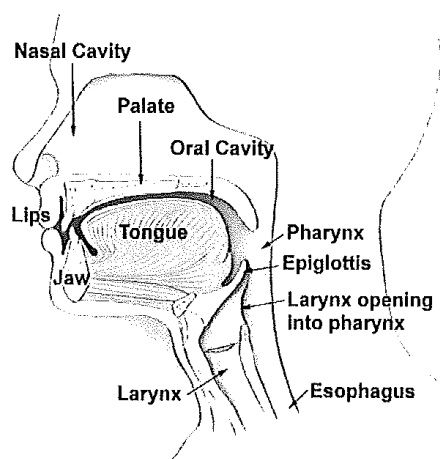
Invacare Platinum™ Series



*The following is an excerpt from RN.com's Update on
Tracheostomy Care course booklet*

INTRODUCTION

Taking care of a patient with a tracheostomy (trach) requires you to know about natural and artificial airway anatomy, signs and symptoms of hypoxia, sterile vs. clean technique, and appropriate nursing actions if the trach tube accidentally comes out. Putting your patient's medical condition aside for the moment, this course will focus on how to adapt your care to the presence of a tracheostomy.



Courtesy of the National Cancer Institute, 2004. www.nci.gov

TRACHEOSTOMY FACTS

In the span of your nursing career you may be responsible for the following patients who have tracheostomies:

- A comatose patient
- A patient with cancer of the larynx
- A burn patient with inhalation damage
- A COPD patient on mechanical ventilation
- A pediatric patient with a congenital airway obstruction

Tracheotomy is the surgical procedure that creates a tracheostomy. It is rarely done as an emergency because oral or nasal intubation or cricothyrotomy is much faster and less complicated when managing respiratory arrest. Tracheotomy is performed for the following reasons:

- To bypass an obstruction
- To maintain an open airway
- To remove secretions more easily
- To oxygenate and/or provide mechanical ventilation on a long-term basis

Mechanical ventilation is the second most frequent ICU intervention, following treatment of cardiac arrhythmias (Fenstermacher & Hong, 2004). About a third of ICU patients are on ventilators for up to six days. Those who cannot be weaned off in a few weeks are switched from endotracheal tubes to tracheostomy tubes for airway management.

TRACHEOTOMY PROCEDURES

Tracheotomy performed in the operating room (surgical tracheotomy) is done under general anesthesia. Two or three tracheal cartilage rings are exposed and cut so that a trach tube can be inserted. Retention sutures are often placed in the cartilage with the ends taped to the patient's skin.

Percutaneous dilatational tracheotomy (PCT or PDT) is done at the patient's bedside, usually in the ICU. The patient is sedated with a narcotic and/or tranquilizer. Under local anesthesia a large bore needle is inserted into the trachea. A guide wire is placed in the opening and a series of dilators placed over the guide wire to create a stoma into which a trach tube is inserted. This procedure takes approximately 15 minutes.

A third procedural choice is surgical tracheotomy done at the bedside (Imperatore, et al., 2004). This is a compromise solution that reduces the number of patients having to go to the OR. Percutaneous dilatational tracheotomy is contraindicated in a quarter of patients requiring tracheotomy, mostly due to anatomical irregularities or coagulation problems. Bedside tracheotomy can be preferable because it allows for continuity of monitoring, causes less upheaval for the patient, and costs less than a tracheotomy in the operating room.

The risks involved during each of these procedures are similar. They are related to reactions to medication and anesthesia, uncontrollable bleeding, respiratory problems, and the possibility of cardiac arrest (SIMS Portex, 1998; Caulfield & Astle, 2003). Generally, 6% of patients have post-procedural complications such as abnormal bleeding or wound infection (Imperatore, et al., 2004). In one study comparing surgical tracheotomy patients with PCT patients, the PCT patients show a lower incidence of these complications (SIMS Portex, 1998; Caulfield & Astle, 2003).

Reasons for a Tracheotomy

- Inherited abnormality of larynx or trachea.
- Blockage of airway by tumor, foreign body, soft tissue swelling, or collapse of throat structure.
- Severe neck, mouth or throat injuries.
- Inability to swallow or cough.
- Ineffective expulsion of respiratory secretions.
- Long-term unconsciousness/coma.
- Need for long-term mechanical ventilation.

Post-Procedural Care

The first two days following tracheotomy are especially uncomfortable for your patient. Your patient is adjusting to the trauma of surgery, the pain of a fresh incision, the presence of a foreign object in the trachea, and the inability to communicate through speech. Patients commonly report choking sensations (Robinson, 2000) and generally take one to three days to adapt to breathing through a tracheostomy tube (Medline Plus, 2003).

If your patient had a PCT, a common protocol is to check vital signs every fifteen minutes for an hour, every half an hour for the next hour, then hourly for four hours (Caulfield & Astle, 2003). Follow the monitoring protocol for patients returning from the operating room. Your facility guidelines may differ; follow the guidelines for your facility.

Respiratory secretions will temporarily increase in your patient after a tracheotomy. Look for signs and symptoms of impaired gas exchange created by mucus plugs. Encourage your patient to deep breathe and cough. Ensure adequate humidification and fluid intake to keep secretions thinned.

Some amount of bleeding from the stoma is expected for a few days but constant oozing is abnormal and requires intervention. A blood vessel may need surgical ligation or you may be directed to pack the wound around the tube to stop the bleeding.

Some inflammation commonly occurs at the surgical site, showing redness, pain, swelling, and drainage. Lower respiratory infection requires more frequent assessment and antibiotic intervention.

Sometimes air escapes into the incision creating subcutaneous emphysema around the stoma that can be felt if pressed. This is generally of no clinical consequence.

Excessive manipulation of the trach tube during coughing and suctioning can break insecure ties and dislodge the tube. Within the first 48 hours the freshly created stoma may close shut, constituting a medical emergency. To minimize this risk, trach ties are not changed for 24 hours and the first tube change is generally done by a physician after a week has passed (Lewis, Heitkemper & Dirksen, 2000). Your facility will have emergency policies and procedures to follow in the case of a dislodged fresh tracheostomy.

Types of Tracheostomy Tubes

You will encounter different kinds of trach tubes selected for individual patient needs. The most common type is the three part universal tube. It has an outer cannula with an inflatable cuff; an inner cannula with an adaptor for connecting to a ventilator or other equipment; and an obturator with a rounded tip for smoothly inserting the outer tube and avoiding trauma to the tracheal wall. A cuffless model is used for long-term trach patients whose gag and cough reflexes are intact. For the acute care patient a pilot tube allows the cuff to be inflated with air, foam, or water, providing a closed airway for mechanical ventilation and preventing aspiration of gastric or oral secretions.

Tubes may be made of metal, PVC material, or silicone and will differ accordingly in the degree of flexibility they provide. For infants and small children, single cannula, soft plastic trach tubes are usually used (Bissell, 2004). These are generally without cuffs but still adaptable for mechanical ventilation equipment. Disposable and reusable trach tubes are both available, and tubes can be custom made.

Some trach tubes are designed to allow patients to speak. Patients being weaned off trach tubes may have either a cuffless, fenestrated tube with an opening that allows air to flow across the larynx, or a tracheostomy button that does not extend into the trachea enough to restrict airflow past the larynx.

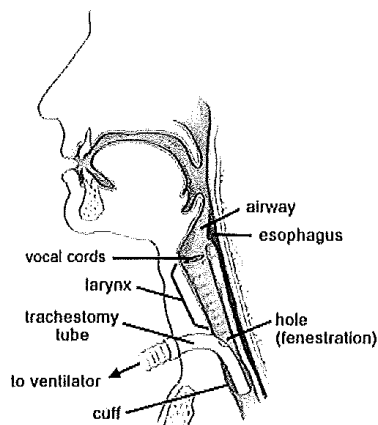
For long-term tracheostomy patients, speaking is possible with these options:

- A fenestrated inner cannula inside a cuffed outer cannula allows speech when the cuff is deflated. Some tubes have cuffs that expand on inspiration and deflate on expiration allowing speech as you expire. Others have cuffs that have to be manually deflated.
- A speaking trach valve is a diaphragm attached to the trach tube. It opens on inspiration and closes on expiration so that air is forced up over the vocal cords when there is no inflated cuff blocking the flow.
- A speaking trach tube forces air or oxygen from an outside source to flow across the vocal cords, independent of the airflow within a closed system created by a cuffed trach tube. The patient has control over this air line with a thumb port.

NURSING CARE OF YOUR TRACHEOSTOMY PATIENT

Don't let the equipment distract you from your first priority: assessing the patient. Look for signs of hypoxia, infection, and pain while establishing rapport. Then check out the trach tube, any tubing and equipment connected to it, and the stoma site. Observe for redness, purulent drainage, and abnormal bleeding at the stoma site. Note the amount, color, consistency, and odor of secretions. Listen to breath sounds with a stethoscope. Before beginning any care ensure that the appropriate emergency trach replacement tubes and CPR equipment is at the bedside.

Trach patients need assistance to mobilize secretions. Their artificial airway bypasses natural humidification and imposes a foreign object that the body reacts to. In addition, many patients have acute and/or chronic diseases that predispose to stagnation of secretions. Frequent repositioning, deep breathing and coughing, chest physiotherapy, postural drainage, oral and parenteral hydration, and supplemental humidification all help to thin and mobilize secretions. Humidifiers and nebulizers may be used with or independent of mechanical ventilation. Tubing from an external moisture source accumulates moisture and needs frequent draining. Ensure the tubing is positioned lower than the patient to avoid aspiration. A moisture conservation device, called a heat moisture exchanger, can also be attached to the outside of a trach tube for long-term trach patients (Bissell, 2004).



Graphic courtesy of the Muscular Dystrophy Association, www.mdausa.org

Suctioning

Suctioning is necessary for all trach patients to remove secretions and assess airway patency. Acute care patients need to be assessed every two hours for the need for suctioning. Suctioning is routinely done twice a day but more often if needed, particularly following tracheotomy or when there is an infection present.

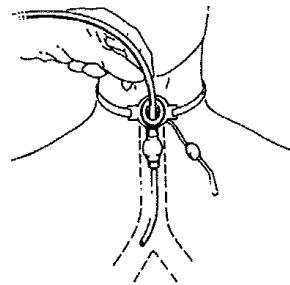
Suctioning activates psychological and physiological reflexes that make the experience both uncomfortable and frightening for your patient (SIMS Portex, 1998). They may have severe hypoxia, cardiac arrhythmias, and even cardiac arrest when the airway is occluded by the catheter and air is simultaneously sucked out of the lungs. This risk can be minimized by following technical parameters arrived at by consensus among clinicians and researchers (American Thoracic Society, 2004; Lewis, Heitkemper & Dirksen, 2000; Robinson, 2000; Bissell, 2004):

Indications for Suctioning

- Dyspnea: flared nostrils, chest retractions, prolonged wheezing
- Noisy breathing
- Cyanosis, clammy skin
- Restlessness, agitation
- Copious secretions, moist cough
- Low oxygen saturations
- Increased peak inspiratory pressure on mechanical ventilator

(Lewis, Heitkemper & Dirksen, 2000; Robinson, 2000; McConnell, 2002; Bissell, 2004)

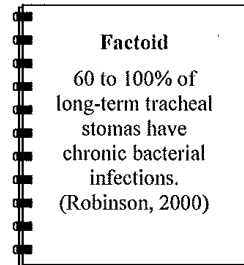
- Position patient in semi-Fowler's. Time suctioning for prior to eating.
- Choose a catheter not exceeding half of the diameter of the trach tube.
- Hyperoxygenate before each pass with the catheter, although some initial suctioning should be done if using bag ventilation so as not to drive secretions deeper toward the lungs. (Exceptions to hyperoxygenation are children and those with long-term trachs.)
- Insert catheter to a pre-measured depth matching the length of the tube and only to a point of resistance if deeper suctioning is necessary.
- Use saline only as needed to loosen plugs.
- Supply suction intermittently while rotating unless the catheter has side holes.
(Controversy exists on whether to apply suction on withdrawal only or on both insertion and withdrawal.)
- Limit suctioning to 5 seconds for pre-measured depth and 15 seconds for deep suctioning.
- Use suction pressure between 120 and 150 mmHg.
- Limit suctioning to 3 passes and discontinue if heart rate drops by 20, increases by 40, produces arrhythmias, or decreases oxygen saturation to less than 90%.
- Suction mouth after trach suctioning to remove secretions above a cuffed tube, but do not contaminate the trach by going from mouth back to trach.



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Routine Tracheostomy Care

Trach ties are generally changed daily after the first 24 hours. To lower the risk of accidental decannulation (the trach tube coming out) the tie changes should be done by two people or with new ties secured before old ties are removed (McConnell, 2002; Bissell, 2004). Twill tapes, Velcro tapes, metal chains, and plastic IV tubing are some options. You should be able to easily slip one or two fingers between the ties and the neck for a proper fit. Do not use Velcro if there is a possibility the patient will try to pull them apart.



The skin around the stoma is often cleaned with swabs soaked in half-strength hydrogen peroxide, rinsed with normal saline solution and patted dry. Some occasional redness and purulent drainage may be expected. Topical treatment can be used for minor infections. Dressings around the stoma are only changed for excessive exudate. If necessary, they should be uncut gauze or sponges and changed frequently enough to keep the area dry.

The majority of trach tubes have inner cannulas that require cleaning one to three times daily unless they are disposable. Use sterile technique to clean the reusable cannula with half-strength hydrogen peroxide and normal saline solution. Reinsert and lock in place within a fifteen minute timeframe.

Cuff Pressure

If your patient has a cuffed trach check cuff pressure every four to eight hours. Complications can arise quickly from excessive pressure that inhibits capillary perfusion. Ideally, pressure should be less than 20 mmHg as measured with a manometer or at a water fill level less than 25 cm (Lewis, Heitkemper & Dirksen, 2000; Bissell, 2004). Record the pressure reading and report if you notice it takes increasing volumes to inflate the cuff. Increasing volumes may indicate that the valve may be faulty or tracheal changes may be responsible.

Deflating and inflating the cuff is a way to:

- Assess how the cuff is working.
- Periodically relieve pressure on the trachea.
- Let secretions above the cuff to drain down so you can suction them.

The frequency of this procedure will most likely line up with suctioning and the routine care schedule.

There are two ways to determine the best cuff pressure. The occlusive technique is used when the cuff has a pressure relief valve for self-adjustment. The minimal leak technique is used to provide some pressure slack by releasing a small amount of pressure after inflating the cuff to a point indicating a tight seal. With a stethoscope placed on the neck inflate the cuff until you no longer hear hissing. Then deflate in tiny increments until a slight hiss returns.

Changing the Trach Tube

Trach tubes, (both the single cannula type and the outer cannula of a universal type), are changed every one to four weeks. Metal tubes can eventually develop cracks at the soldered joints. Silicon types can crack or tear. Soft PVC tubes stiffen with age. When a patient has had a tracheostomy for several months, the stoma is well formed and tube changes can be safely done on a monthly basis, even at home, using a clean technique. In the hospital however, safety requires two people using sterile technique for inserting a new tube. The initial tube change is usually done by a physician (SIMS Portex, 1998). Be sure that your patient has not eaten or received a tube feeding at least an hour before this procedure. For cuffed tubes, test the cuff by inflating and deflating before inserting it. Always use the obturator for a smooth guide to insertion.

Eating and Communication

A tracheostomy will not prevent a patient from eating although some patients may have concurrent swallowing problems that need evaluation by an otolaryngologist or speech pathologist. Patients may have poor appetite because of disease or in reaction to copious respiratory secretions. Suctioning prior to meals is helpful.

Inability to speak is anxiety-provoking for most patients and you need to devise some alternative methods of communication until long-term speaking solutions are initiated. Your patients require an extra measure of sensitivity in the first few days post-tracheotomy while they are coping with choking sensations and pain. A call button available is crucial. You may try a writing pad or at least a yes/no system to communicate.



COMPLICATIONS

Complications from a tracheostomy can arise in the first few days or within several weeks. Initially, the most common ones are:

- Inflammation and edema of the trachea
- Infection and abscess of the stoma and/or pulmonary tree
- Bleeding associated with suctioning

(Bissell, 2004; SIMS Portex, 1998)

If humidity is insufficient, the mucous membranes dry out and the irritation of an inserted catheter will cause small amounts of bleeding during routine suctioning.

Long-term complications from the presence of a trach tube are due to tracheal scarring and erosion. Stenosis, the narrowing of the trachea from scar tissue, occurs in 5 to 15% of patients (Fenstermacher & Hong, 2004). This development escalates with a history of endotracheal intubation and/or excessive trach tube cuff pressure. Scarring can occur at the stoma, the tube cuff site, or at the point where the distal end of the tube presses on the tracheal wall. It may cover a large area extending beyond the trachea, in weblike fashion, or appear as a localized granuloma.

Your patient most likely will not be scoped to assess tracheal stenosis until after the trach tube is taken out. Stenosis is not significant enough for surgical intervention unless it narrows the airway more than 50% (Fenstermacher & Hong, 2004). Treatments for scarring are:

- Serial dilation.
- Endoscopic excision.
- Anterior cricoid split or laryngotracheoplasty.

(Bissell, 2004)

Fistulas take months to develop. The constant pressure from a poorly fitted trach tube, excessive cuff volume, and/or a nasogastric feeding tube all contribute to tissue necrosis. A fistula can develop between trachea and esophagus or grow into the wall containing a major artery. Aspiration of gastric contents is the consequence for one path of erosion; hemorrhage results from the other. If your patient is coughing and choking during meals, you suspect food particles are in the trach secretions, and trach cuff inflation requires increasing amounts of air, your patient may have a tracheal-esophageal fistula (Schreiber, 2001; Dixon, 2003). Suctioning grape juice or blue-dyed liquid from the trach after your patient drinks it is one way to test this. A patient with a fistula should be NPO and evaluated for surgery.

Complications	
Common	Long-term
Tracheal irritation	Stenosis
Infection + abscesses	Webbing + granulomas
Mucosal bleeding	Fistulas

WEANING

Tracheostomy tubes are discontinued either surgically or through a transition process of intermittent trials. The trach tube is capped or plugged for periods of time until the patient can tolerate it for 24 hours. Assess your patient's risk of aspiration before taking the tube out. There may be some residual swallowing impairment caused by cuff pressure on swallowing muscles (Lewis, Heitkemper & Dirksen, 2000). Systematic downsizing of the tube may also be used in weaning. Once the tube is taken out, the stoma usually closes by itself gradually. If not, minor surgery will close it.



Tracheostomy Care:

Respiratory Suctioning





Respiratory Suctioning Instruction Check Sheet

Demonstrate:

- _____ Sterile technique for suctioning
- _____ Resident assessment during suctioning
- _____ Proper placement of machine
- _____ How to turn machine on
- _____ How to adjust suction pressure
- _____ Proper assembly of suction circuitry
- _____ How to clean equipment
- _____ How to change filters

Explain:

- _____ Different types of suction catheters
- _____ Indications for suction machine
- _____ Safety precautions/Electrical Hazards
- _____ Infection Control

Nurse: _____

Instructor: _____

Date: _____

Respiratory Suctioning Overview

1. Each resident has a specific trach tube, as ordered by a Physician.
2. Every trach resident should have a spare back up trach at the bedside for emergency reinsertion.
3. Tracheostomy tubes have different sizes and styles:
 - a. Adult and pediatric
 - b. Cuffed and un-cuffed
 - c. Fenestrated and non-fenestrated
 - d. Disposable inner cannulas and non-disposable inner cannulas
 - e. Different sizes
 - f. Different brands
4. Trach tubes and stoma sites require regular cleaning.
5. Trach tubes should be changed monthly.
6. Hazards of tracheostomies:
 - a. If there is redness, bleeding, or drainage from stoma, it should be reported to the resident's nurse.
 - b. Whenever the tube is manipulated, respiratory, cardiovascular and skin parameters should be assessed.
7. Humidification is necessary for artificial airways.
8. Suctioning is necessary to insure patent airway.

Respiratory Suctioning
Educational Booklet

Tracheostomy Suctioning Procedures



*The following is an excerpt from Nursing Times' Practical
Procedures Manual*

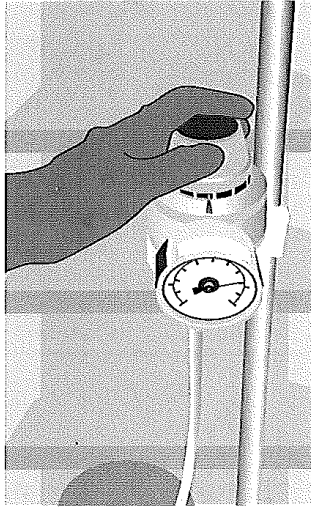


Fig 1. Select the appropriate vacuum pressure

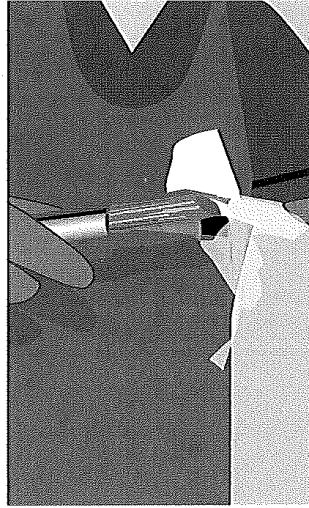


Fig 2. Attach the catheter port to the suction tubing

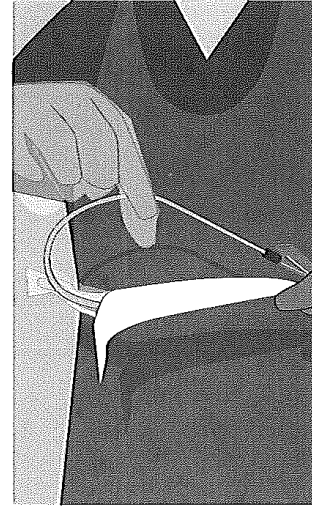


Fig 3. Put on glove and remove the catheter from the packaging

Tracheostomy care

Part 1 – Using suction to remove respiratory secretions via a tracheostomy tube

AUTHOR Dan Higgins, RGN, ENB100, ENB998, is senior charge nurse, critical care, University Hospitals Birmingham NHS Foundation Trust.

INTRODUCTION

One of the indications for creating a tracheostomy is to provide access to the airway to clear respiratory secretions.

However, when a tracheostomy tube is inserted, the patient's ability to remove respiratory secretions will usually be compromised. This is because the normal coughing mechanism is hindered as the patient is unable to close the glottis. Closure

of the glottis allows intrathoracic pressure to increase and generate the high gas flow/velocity required for coughing.

The consistency of respiratory secretions is also affected by the tracheostomy as the mechanism of warming and humidifying air through the upper airway is lost. Secretions become thick and dry, which inhibits mucociliary transport. They can build up and may block the tracheostomy tube.

Endotracheal suctioning is performed to maintain a clear airway and optimise respiratory function (Dougherty and Lister, 2008). It can be performed via a tracheostomy tube. A number of risks are associated with it. These include:

- Hypoxia – as oxygen flow is interrupted and the airway partially obstructed;
- Alveolar collapse – as gas is aspirated out of the bronchial tree;
- Tracheo-bronchial trauma;
- Infection;
- Haemodynamic instability resulting from stimulation of the vagus nerve which supplies the larynx, trachea, lungs and heart.

When to perform suction

The decision to perform suction must be based on a comprehensive patient assessment rather than using set times.

This assessment will include a review of characteristics such as respiratory rate and pattern, chest excursion and palpation and auscultation of the chest (Higgins, 2005).

The equipment needed is as follows:

- Vacuum generator/collection device/tubing;
- Selection of appropriate-sized catheters;
- Gloves;
- Apron;
- Eye protection;
- Gallipot/small bowl;
- Saline/water solution.

There appears to be some controversy over the use of sterile or non-sterile gloves. The Department of Health (2001) recommends that gloves should be worn as single-use items and not be powdered. Local policies should be consulted.

Patients having suction should be observed closely for any signs of cardiovascular instability during and after the procedure.

Nikki Todd

PROFESSIONAL RESPONSIBILITIES

This procedure should be undertaken only after approved training, supervised practice and competency assessment, and carried out in accordance with local policies and protocols.



Fig 4. Introduce about one-third of the catheter into the tracheostomy

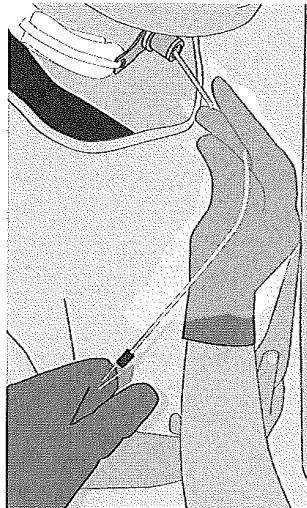


Fig 5. Apply suction by placing thumb over the port control and withdraw

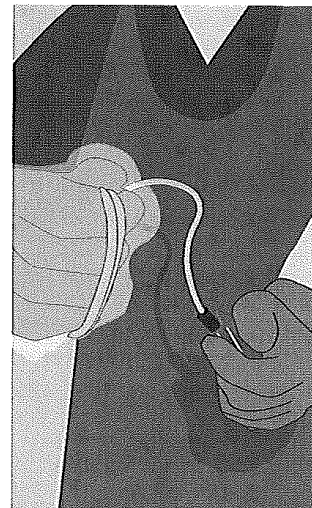


Fig 6. Wrap catheter around gloved hand and discard

Carrying out suction via a tracheostomy puts staff at risk from splash/inoculation injury. Local infection control procedures must be followed.

THE PROCEDURE

- Prepare the patient, obtain informed consent and discuss any anxieties.
- Wash hands and put on an apron, non-sterile gloves and eye protection as required.
- Encourage deep breathing and, if the patient is receiving oxygen and there are no contraindications, increase inspired oxygen concentration. Any change in concentration must be prescribed. These measures may help to reduce the risk of hypoxia and alveolar collapse (Higgins, 2005).
- Select vacuum pressure (Fig 1). This should be at a low level. The general recommended pressure range is 8–20kPa (Pryor and Prasad, 2001).
- Select a suction catheter. This should be no more than half the internal diameter of the tracheostomy tube – a useful rule of thumb is to use the smallest catheter possible

that is effective at aspirating the secretions. Using catheters with more than one suction eye cuts the risk of trauma. Suction catheters should be sterile and single-use only.

- Open the end of the catheter package to expose the catheter port. Hold the catheter, which is still in its packaging, and attach the catheter port to the suction tubing (Fig 2).
- Put a sterile/clean glove on the dominant hand; remove the catheter from the packaging, avoiding contamination (Fig 3).
- Introduce the catheter into the tracheostomy to approximately one-third of the catheter length (Dougherty and Lister, 2008). Introduce the catheter no further than the carina (the point at which the trachea divides into right and left bronchi). Direct stimulation of the carina will, in most cases, stimulate a cough. However, this stimulation can cause trauma and the aim should be to remove secretions without touching the carina (Fig 4).
- Apply suction by placing the thumb over the port control and withdraw the catheter, rotating the catheter (if suggested by local policy). Ensure the catheter is inserted for less than 10 seconds (Fig 5).
- Wrap the catheter around the dominant hand, remove the glove over the catheter and discard (Fig 6). This reduces risks of cross-contamination and splash injury.

REFERENCES

- Department of Health (2001) Standard principles for preventing hospital-acquired infections. *Journal of Hospital Infection*; 47 (supplement): S21–37.
- Dougherty, L., Lister, S. (2008) *The Royal Marsden Hospital Manual of Clinical Nursing Procedures* (7th edn). Oxford: Blackwell Publishing.
- Higgins, D. (2005) Tracheal suction. *Nursing Times*; 101: 8, 36–37.
- Pryor, J.A., Prasad, S.A. (2001) *Physiotherapy for Respiratory and Cardiac Problems: Adult and paediatric*. Edinburgh: Churchill Livingstone.

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NEXT WEEK

Tracheostomy care 2:
 How to change an inner tube